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Groza et al.

[11] **3,785,139**

[45] **Jan. 15, 1974**

[54] **WIRE-ROPE WINDING MACHINE AND METHOD OF ITS OPERATION**

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[52] **U.S. Cl.** **57/58.34,** 57/58.76, 57/78, 318/489

[51] **Int. Cl.** **D07b 3/12,** D07b 7/02

[58] **Field of Search** ..... 57/34 R, 58.3, 58.32, 57/58.34, 58.36, 78, 58.72, 58.76, 100, 81; 318/466–470, 489

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Assistant Examiner—Charles Gorenstein
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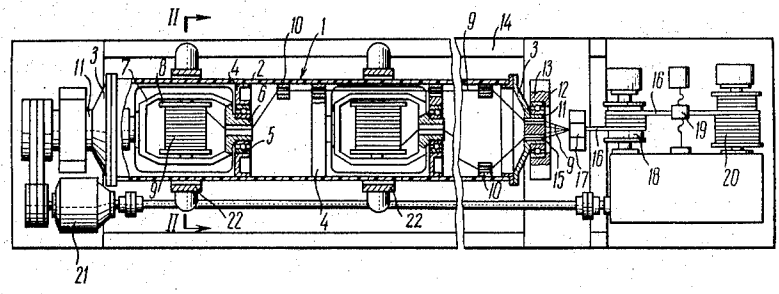
[57] **ABSTRACT**

In the swinging portion of the wire-rope winding machine the holder with the reel is so positioned inside the rotor that their common centre of gravity lies on the rotor axis. The holder is restrained from rotation when the rotor is in motion by means of an electromagnet in whose magnetic field the holder is located. Deviation of the holder from the normal position is signalized by transducers disposed in the magnetic field of each electromagnet.

The design of the twisting portion permits the axis of the machine rotor to be located in the vertical or inclined position.

2 Claims, 9 Drawing Figures



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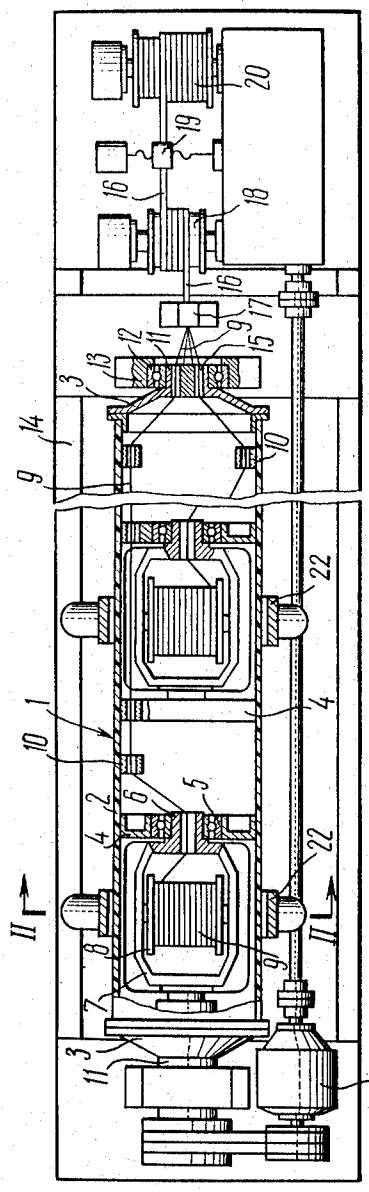

FIG. 1

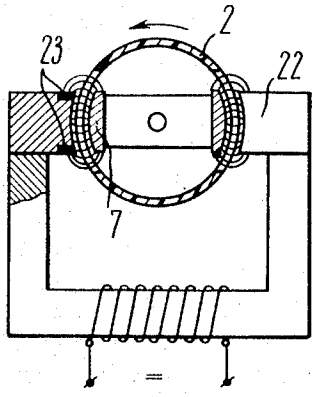

FIG. 2

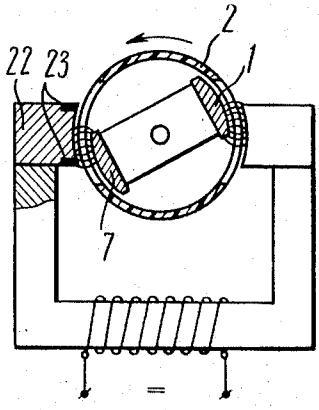

FIG. 3

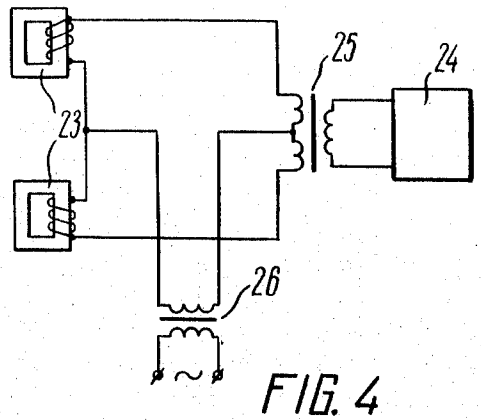

FIG. 4

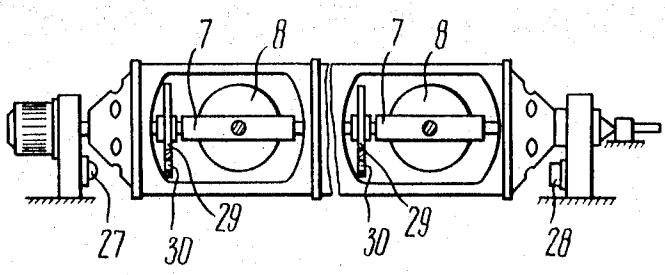

FIG. 5

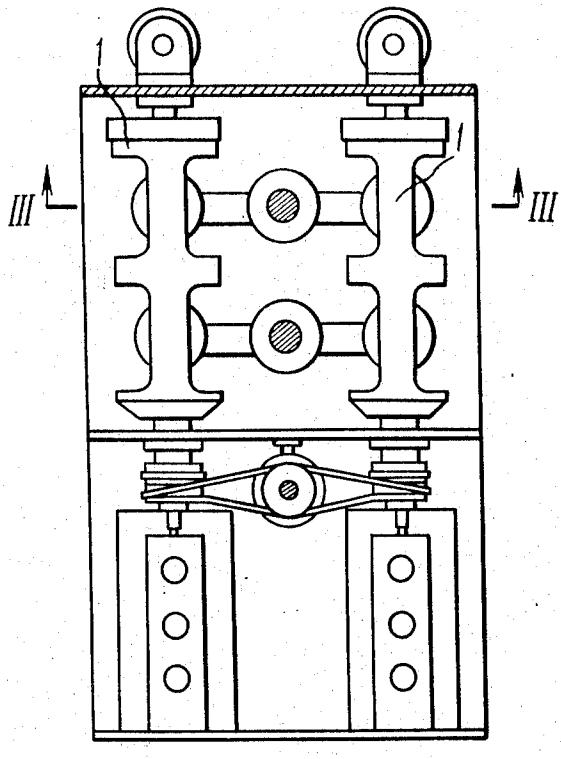

FIG. 7

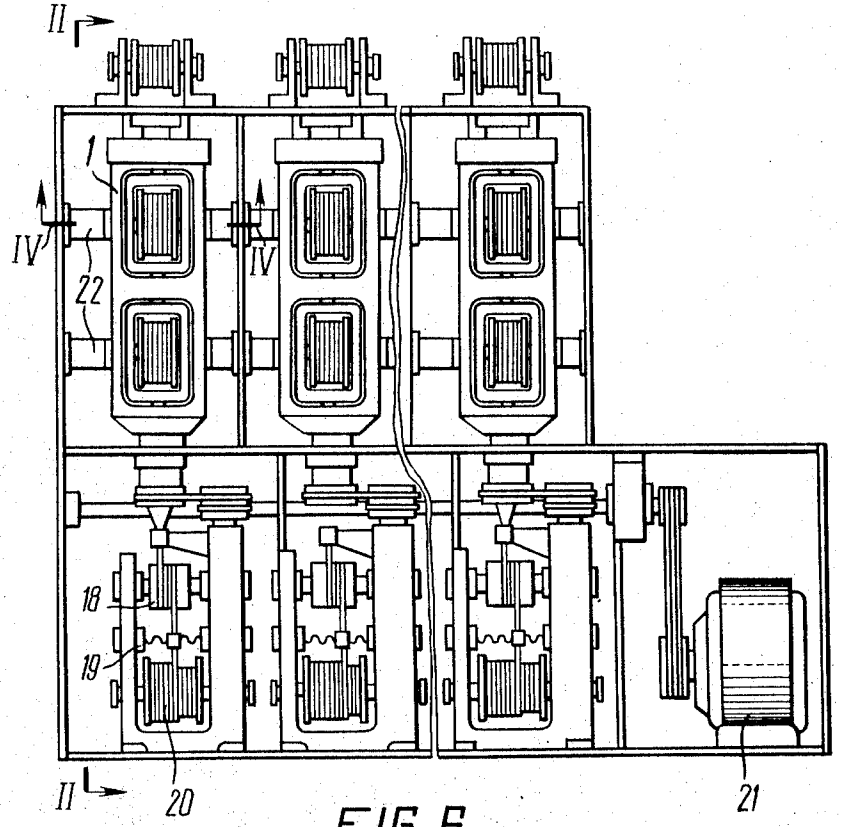

FIG. 6

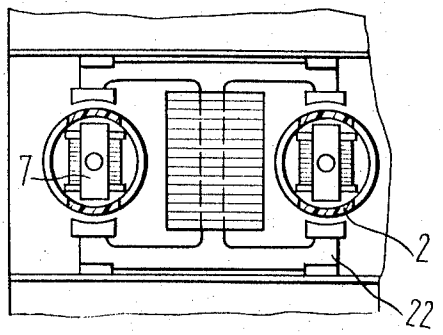

FIG. 8

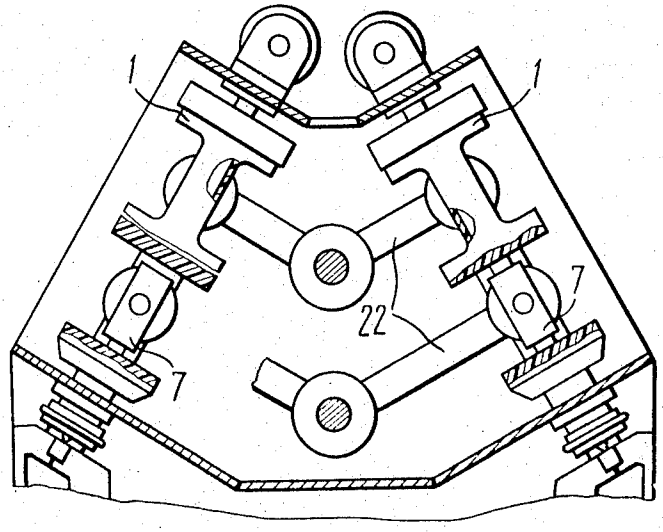

FIG. 9

WIRE-ROPE WINDING MACHINE AND METHOD OF ITS OPERATION

BACKGROUND OF THE INVENTION

The present invention relates to a wire-rope winding machine and method of its operation.

This invention may be utilized the wire-rope and electric-cable production industries, for example, in the production of metal cord, cable and their strands.

Known in the art is a wire-rope winding machine having a twisting portion which incorporates a frame mounting a hollow rotor on supports with at least two wire reel holders installed in the rotor along the axis thereof and kept stationary during rotation of the rotor and equipped with holder position signalizers which operate when the holder is seized by the rotor, and a rope forming die fixed on the frame coaxially with the rotor.

Holes are made in the side surface of the rotor to install the wire reels. The number of reels depends on the type of the rope produced. The rotor is rotated by means of a drive unit which is also connected to a drawing drum followed the forming die, as well as to a rope guiding mechanism and a receiving drum.

In twisting wires to make a rope, the wires should be prevented from spinning around their axis so as to avoid structural stresses. This requirement can be met if the wire reels are kept stationary during rotation of the rotor.

In the known wire-rope winding machine the reel holders are installed inside the rotor in such a way that their centres of gravity are located below the rotor axis. In this case the holders are installed in bearing supports and during rotation of the rotor the holders remain stationary. Machines having a twisting portion of this design allows only the horizontal positioning of the axes of the rotors which is a disadvantage because it leads to uneconomical use of the production floor areas.

Another significant disadvantage of the machine of known design lies in the fact that the holder rotates together with the rotor if a bearing failure arises in the support, thus resulting in the holder becoming seized.

Because the centre of gravity of the holder is off-set in relation to the rotor axis, the rotation of the holder generates a centrifugal force acting on the holder and the rotor supports which often completely destroys the machine. In addition, this process is so rapidly developed (not longer than 1–2 sec) that timely stoppage of the machine by an operator is paractically impossible.

The machines of prior art also incorporate devices for automatic cut out of the drive units.

However, these devices are sensitive only to the developing destruction process but not to its commencement. In one known case this device takes the form of a vibration transducer sensible to increased vibrations, in another case it is a mercury switch which cuts out the drive unit of the machine when the holder turns to a certain angle from its normal position.

The first of these devices is reacts too slow because it only indicates the result of the holder seizure, but not the commencement of the process. The second device cannot be relied upon because a signal transmitted from the mercury switch to an actuator to cut out the drive unit has to go through several sets of slip rings which are unreliable in operation.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to obviate the above disadvantages and to provide a wire-rope winding machine with a twisting portion of such a design which ensures reliable and trouble-free operation of the machine and permits positioning of its rotor other than horizontal for more efficient use of the production floor area.

This and other objects are achieved due to provision of a wire-rope winding machine having a twisting portion which incorporates a frame mounting a hollow rotor on supports with at least two wire reel holders installed in the rotor along the axis thereof and kept stationary during rotation of the rotor and equipped with rotor position signalizers acting when the holder is seized by the rotor, and a rope forming die fixed on the frame coaxially with the rotor.

According to the invention, the twisting portion of the machine mounts the electromagnets with the magnetic field of each of them encompassing the corresponding reel holders, the reel holders being so positioned inside the rotor that the centre of gravity of each of them lies on the axis of the rotor which is made of non-magnetic material. The holder position signalizer represents essentially two choking transducers positioned in the magnetic field of each electromagnet and electrically connected to the rotor drive unit and adapted to stop the rotation of the rotor when the holder deviates from the given position.

The location of the centres of gravity of the reel holders on the rotor axis excludes any centrifugal force which could destroy the machine in case the holder is seized by the rotor, i.e., the machine operation becomes trouble-free.

The wire-rope winding machine, according to the present invention, with a swinging portion embodied as described above to permit its operation is characterized in that the machines are positioned in two rows, while the axes of the rotors of their twisting portions are located at an angle of 0°–60° to the vertical.

Such positioning of the rotors of the wire-rope winding machines permits a substantial reduction of the floor area occupied by the machines and an improvement in the servicing conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to make the present invention more readily understood a specific embodiment thereof will now be described with reference to the accompanying drawings in which:

FIG. 1 is a longitudinal section of the plan view of the wire-rope winding machine with a twisting portion according to the invention;

FIG. 2 is a section along II—II in FIG. 1;

FIG. 3 is as FIG. 2, the holder being shown deviated from the normal position;

FIG. 4 is a connection diagram of the holder position transducers;

FIG. 5 is a general view of the wire-rope winding machine, showing one version of the embodiment of the holder position signalizer;

FIG. 6 is a general view of the wire-rope winding machines with the twisting portions thereof installed vertically;

FIG. 7 is a view along arrow II—II in FIG. 6;

FIG. 8 is sectional view along III—III in FIG. 7; and

FIG. 9 is a side view of the wire-rope winding machines whose twisting portions are angled to the vertical.

Referring now to FIG. 1, the wire-rope winding machine has a twisting portion which incorporates a rotor 1 representing essentially a cylindrical shell 2 whose ends are closed with covers 3.

Installed inside the shell 2 along its axis are supports 4 with bearings 5 which mount axles 6 with holders 7 of reels 8 wound with wire 9.

The axles 6 of the holders 7 are hollow to draw the wire 9 off the corresponding reel 8.

Fixed on the surface of the shell 2 of the rotor 1 along the generating line of the shell are ceramic rings 10 serving as guides for the wire 9 delivered out of the axle 6 of the holder 7 of each reel 8.

Made integral with the covers 3 are axles 11 of the rotor 1 which are housed in bearings 12 installed in supports 13.

The supports 13 are fixed on the frame 14.

The axles 11 have longitudinal through holes 15 which are parallel to the rotor axle and serve to pass the wire 9. The number of holes 15 is equal to that of the reels 8 with the wire 9.

To form a rope 16 of the wire 9, a forming die 17 is installed on the frame 14 which is positioned outside the rotor 1 and coaxially with it. Wires 9 converge in the die after passing through the holes 15 in the axle 11 of the rotor 1.

A drawing drum 18 is provided to draw the rope 16 out of the die 17. Disposed after the drawing drum 18 is a guiding mechanism 19 to place the rope 16 on a receiving drum 20.

The rotor 1, the drawing drum 18, the rope guiding mechanism 19 and the receiving drum 20 are installed on the frame 14 and are operated from a common drive unit 21 with which they are kinematically linked.

Each holder 7 with the reel 8 is so installed in the rotor 1 that their common centre of gravity lies on the axis of the rotor 1. Due to this arrangement, no destructive centrifugal force occurs which would destroy the machine in case of failure or jamming of the bearings 5 wherein the holder 7 is mounted, or if the holder 7 is seized by the rotating rotor 1.

The technology of making the rope 16 requires that to prevent spinning of the wire 9 along its axis each holder 7 should remain stationary during rotation of the rotor 1.

The requirement is met by the following arrangement.

According to the invention, an electromagnet 22 is installed on the frame 14 beyond the rotor 1 for each individual holder 7. The magnetic field of each electromagnet 22 encompasses the corresponding holder 7 to restrain it from rotating when the rotor 1 is in motion. To prevent screening of the magnetic field the shell 2 of the rotor 1 is made of a non-magnetic material, such as fibreglass plastic. The electromagnets 22 are energized from an alternating current mains or a direct current source (not shown in the drawing).

As the capture of the holder 7 by the rotating rotor 1 leads to spinning the wire 9, provision is made to signalize this by means of two choking transducers 23 (FIGS. 2 and 3) sensing variations in the position of the holder 7. The choking transducers 23 are disposed in the magnetic field of each electroamgnet 22, and particularly in this case, on one of the poles of the electromagnet 22.

The choking transducers 23 are electrically connected to an actuator 24 (FIG. 4) to cut out the drive unit 21 of the machine when the holder 7 deviates from its normal position.

An actuator 24 is connected to the choking transducers 23 via a transformer 25. The choking transducers 23 are connected to each other to form two arms of a differential bridge. The primary winding of the transformer 25 is connected to another two arms of the differential bridge. The transducers 23 via the transformer 25 are wired to the actuator 24 which cut out the drive unit 21 to stop the rotation of the rotor 1 if the holder 7 is captured by the rotor.

A source of alternating current (not shown in the drawing) energizing the transducers 23 is connected to the bridge diagonal via a transformer 26.

The position signalizer of the holder 7 may also take the form of a radiant energy emitter 27 (FIG. 5) and a detector 28 which both are installed on a common axis parallel to the axis of the rotor 1, and a number of discs 29 with a hole 30 rigidly fastened to each holder 7. The hole 30 made in each disc 29 is disposed in the beam path.

The herein disclosed wire-rope winding machine with a swinging portion according to the invention allows the rotor 1 of the machine to be positioned so that the rotor axis occupies any other than horizontal position for convenient servicing of the machine under actual production conditions.

According to the invention, the disclosed design of the twisting portion of the machine permits the rotor 1 to be installed so that its axis is located at an angle of 0° to 60° to the vertical.

FIGS. 6 and 7 show the wire-rope winding machines with the rotors 1 installed vertically in two rows. This makes it possible to reduce the production floor area accupied by the machines 10–15 times compared with the area occupied by known machines. One more advantage of this arrangement is associated with the convenient servicing of the machines which permits a single workman to attend a considerable number of machines with a corresponding increase in of the labour productivity.

FIG. 9 illustrates the machines whose swinging portions are so installed that their rotors 1 are angled to the vertical.

The arrangement is more preferable for the machines incorporating heavy reels 8 whose installation into the holders 7 requires special handling facilities.

Arrangement of the machines in two rows allows a single electromagnet 22 to be used for two adjacent holders 7 of the reels 8 disposed at a common level (FIG. 8).

The wire-rope winding machine operates as follows.

Prior to cutting in the drive unit 21 of the machine, the electromagnets 22 are switched on and simultaneously the power source of the transducers 23 is also switched on.

This gives rise to a magnetic field between the poles of each electromagnet **22** to encompass the corresponding holder **7** with the reel **8**.

The shell **2** of the rotor **1** does not screen the magnetic field of the electromagnets **22** because the shell is made of fibreglass plastic.

Then, the drive unit **21** is cut in.

Rotation of the rotor **1** is thus initiated, drawing drum **18** and receiving drum **20**, and the motion of the mechanism **19** guides the rope **16** so that it is taken up by the receiving drum **20**.

Due to the presence of the magnetic field of the electromagnets **22**, the holders **7** of the reels **8** remain stationary when the rotor **1** is in rotation. The wire **9** does not spin around its axis. Amperage of the power source of the electromagnet **22** should be appropriately chosen so that the magnetic-field intensity set up of the electromagnet **22** is enough to generate a torque in excess of the frictional moment in the bearings **5** of the holder **7**.

The wire **9** is continuously delivered from each reel **8** through the axle **6** of the holder **7** into the corresponding ceramic rings **10** and the holes **15** in the axle **11** of the rotor **1** toward the forming die **17**.

As the rotor **1** is rotating while the forming die **17** is stationary, winding of the rope **16** takes place.

The completed rope **16** is brought to the drawing drum **18**, wherefrom via the guiding mechanism **19** it is collected on the receiving drum.

Any jamming of the bearing **5** in the support **4** of the holder **7** or capture of the holder **7** by the rotating rotor **1** is signalized by the transducers **23**. Altered positioning of the holder **7** results in reshaping of the magnetic field encompassing the transducers **23**, which leads to an unbalanced condition of the differential bridge.

The unbalanced bridge condition causes the secondary winding of the transformer **25** to be energised which sets the actuator **24** in operation to cut out the drive unit **21** of the wire-rope winding machine.

When utilizing a signalizer comprising the radiant energy emitter **27**, detector **28** and a number of discs **29** with holes **30**, which discs are rigidly fastened to each holder **7**, the radiant energy emitter **27** and the detector **28** are switched on simultaneously with energization of the electromagnets **22**.

A beam produced by the emitter **27** is brought to the detector **28** through the holes **30** made in the discs **29** which are fastened to the reel holders.

Should the bearings **5** of one of the holders **7** become jammed the corresponding disc **29** turns and the beam is cut off.

In this case, the radiant energy detector **28** sends a signal to cut out the drive unit **21** of the machine and the rotation of the rotor **1** ceases.

At vertical or inclined location of the axes of the rotors **1** operation of the machines remains unchanged.

The wire-rope winding machine with a twisting portion according to the present invention is reliable and safe in operation and at vertical or inclined positioning of the rotors **1** it becomes possible to substantially reduce the production floor area occupied by the wire-making equipment and increase labour productivity.

What we claim is:

1. In a wire-rope winding machine the twisting portion comprising: a frame mounting a hollow rotor on supports said rotor being made of non-magnetic material; a drive unit for said rotor imparting to the latter rotary motion; at least two wire-reel holders installed in said rotor along the axis thereof so that the common center of gravity of the holders with the reels lies on the axis of the rotor; a wire forming die fixed on said frame coaxially with said rotor; electromagnets installed on said frame with the magnetic field of each electromagnet encompassing the corresponding holder and restraining the latter from rotation when the rotor is rotating; at least two choking transducers positioned in the magnetic field of each of said electromagnets and serving as position signalizers of said holders in case the latter are seized by said rotor during rotation thereof, said choking transducers being electrically connected to said drive unit of the rotor for stopping its rotation when said holder deviates from a stationary position.

2. Wire-rope winding machines with a twisting portion comprising: a frame mounting a hollow motor on supports said rotor being made fo non-magnetic material; a drive unit for said rotor imparting to it rotary motion; at least two wire-reel holders instaled in said rotor along the axis thereof so that the common center of gravity of the holders with the reels lies on the rotor axis; a rope forming die fixed on said frame coaxially with said rotor; electromagnets installed on said frame with the magnetic field of each electromagnet encompassing the corresponding holder and restraining it from rotation together with said rotor; at least two choking transducers positioned in the magnetic field of each of said electromagnets and serving as position signalizers of said holders in case the latter are seized by the rotor during rotation thereof, said choking transducers electrically connected to said drive unit of the rotor for stopping the rotation of the latter when said holder deviates from a stationary position, characterized in that the machines are disposed in two rows, and the axes of the rotors of the twisting portions thereof are located at an angle of 0°–60° of the vertical.

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