

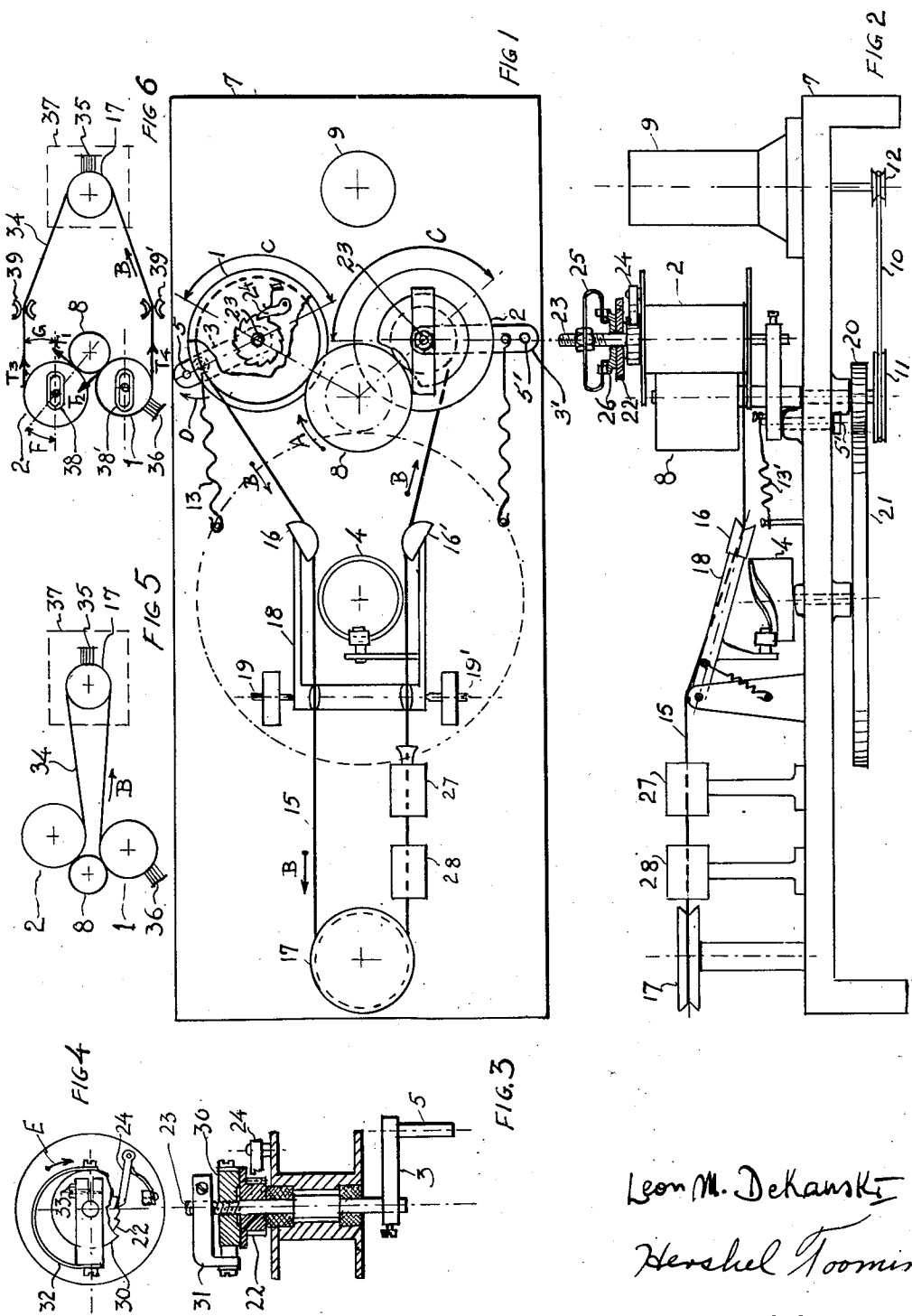
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WIRE-REELING DEVICE

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WIRE-REELING DEVICE

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This invention relates to means for handling of flexible materials, such as threads, wires, strips, etc., which hereinafter will be called "wire." The purpose of this invention is to provide a system whereby any of the aforementioned materials could be wound at a high speed under controlled and, if necessary, extremely small tension. There are many industrial operations where wire of considerable length must be processed. Usually the wire is stored and handled on spools or bobbins and the desired process takes place while the wire is being reeled from one spool to another. The process proper is performed on the section of wire between the two aforementioned reels: this section of the wire hereafter shall be called the "loop."

As an example of the field of application of the said reeling systems the following can be mentioned: Processing of textile fibres and threads, processing of ropes; chemical processing, drawing and dyeing of textile products; surface coating, heat treatment, rust-proofing of metallic wires and strips; wire drawing and forming operations; magnetic inspection, reeling of sound recording tapes and magnetic recording mediums in sound recording instruments, especially when wire of low mechanical strength is used.

The various objects and features of the invention will be more apparent from a consideration of the accompanying drawings and the following description wherein several exemplary embodiments of the invention are disclosed.

In the drawings:

Fig. 1 is a plan view of one form of the present invention;

Fig. 2 is a side elevation view of the device of Fig. 1;

Fig. 3 is a fragmentary elevational cross-sectional view of a modified form of the reel mounting and friction device;

Fig. 4 is a plan view, partly broken away, of the elements of Fig. 3;

Figs. 5 and 6 are diagrams illustrating the principles of operation of the invention.

In Figures 1 and 2, the wire reels 1 and 2 (either of which may alternately be the take-up or the take-off reel) are mounted for rotation on shafts 23 fixed in rocker arms 3 and 3', pivoted through pivots 5 and 5' on frame 7. The rubber-covered driving roller 8 is motivated by the motor 9 through a belt 10 and pulleys 11 and 12. A pressure is maintained between the reels 1 and 2 and the drum 8 by means of springs 13 and 13', each of which is attached at one end to the frame 7 and at the other end to the rocker arms 3, 3'.

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The wire loop 15 extends from one reel to the other through guides 16 and 16' and follows around the idler pulley 17, through a furnace 28 and quench bath 27. The level winding or traverse mechanism is composed of winding rocker 18, to which the guides 16 and 16' are attached. The winding rocker 18 is pivoted on pivots 19 and 19' and actuated by a cam 4, which is geared to the shaft of roller 8 by gears 20 and 21.

The already mentioned driver roller 8 is in contact under a certain amount of pressure with the surface of the wound wire on the reels 1 and 2. If now the roller is rotated as shown by the arrow A, the wire will progress as shown by the arrows B.

The purpose of the level winding mechanism is to provide for a regular cylindrical form of winding on the reels in order to obtain good contact between the driving roller and the winding on the reels.

While the above described part of the system would theoretically provide and maintain a loop of constant length, such condition would be, in practice, highly unstable due to inevitable vibrations, roughness of the winding surface and slip between the roller 8 and the reels 1, 2. In order to eliminate this difficulty and make possible winding under controlled tension, each reel 1, 2 is provided with a clutch and friction device, as follows:

A ratchet wheel 22 with an upper part shaped as a friction plate is freely movable in one direction on shaft 23 while in the other direction it is connected to the reel by ratchet pawl 24. On top of the ratchet wheel 22 and under pressure of spring 25 is located a stationary friction disc 26 splined on the stationary shaft 23. Both of the reels 1 and 2 are provided with the above described friction device with the difference that on reel 1 the ratchet is left-handed while on reel 2 the ratchet is right-handed, so that the friction device operates selectively only on that reel from which the wire is being taken off, while the take-on reel remains frictionless.

Due to this system, a small amount of slippage occurs on the reservoir of takeoff reel when the instantaneous wire speed is lower than the peak surface speed on the take-up reel. Therefore, this combination of friction torque and slippage on the take-off reel acts continuously as a tension compensation system.

The amount of tension in the loop can be controlled by the amount of friction which, in the illustrated case, depends on the force of axially

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acting spring 25 and the pressure between the take-off reel and the driving roller 8.

An additional feature of stability of tension is provided by mounting the rocker arms 3 and 3' in such a way as to obtain an angle C (shown in Figure 1) larger than 90° and preferably between 130° and 150°. Due to such an arrangement the pressure between the winding and the roller is made a function of the sense of rotation. When the wire is being taken on the reel, the rocker arm is being "drawn in" as shown by arrow D and therefore said pressure increases; when the wire is being taken off, the rocker arm is "thrown out" and the pressure decreases.

Since it is sometimes difficult to obtain a constant friction between members 22 and 26 due to unstable qualities of friction surfaces, it may be necessary to use an automatically self-regulating friction device.

Such device is shown in Figs. 3 and 4 where the reel arrangement is similar to that shown in Figs. 1 and 2 with the exception of members 25 and 26.

The friction disc 30 has a threaded engagement on the shaft 23 and is subjected to the torque E by the spring 32. The other end of the spring 32 is attached to the arm 31; the spring tension can be adjusted by varying the angular position of the arm 31 about the stationary shaft 23; for this purpose a clamp 33 is provided on the arm 31.

In the direction of rotation corresponding to take-off or unwinding, the friction force between members 22 and 30 will tend to unscrew the disc 30 and therefore reduce the pressure between the friction surfaces to the limit determined by the torque E provided by the spring 32.

The opposing action of the friction torque and the spring torque, therefore, provide the self-regulating feature.

It is obvious that when the above device is used, there will be one reel with right-hand threaded shaft and counter-clockwise ratchet and one reel with left-hand threaded shaft and clockwise ratchet. On the example shown in Fig. 1, the former would be reel 1 and the latter reel 2.

To facilitate the understanding of the features of this invention, the following analytical outline is given with reference to schematic Figures 5 and 6.

Whereas, this invention deals with a wire reeling system applied to any purpose, a generic purpose to use the wire reeling system is shown by dotted line 37 indicating a "process."

A pulley 17 indicates schematically that there is provided a support of some kind for the wire loop, the frictional resistance 35 indicates that there might be and probably will be resistance against the movement of wire by virtue of the process. The above elements are therefore shown on all of the schematic drawings.

In its simplest form, shown in Fig. 5, the system consists of the following elements:

(a) Driver means 8 with a surface suitable for frictional engagement with the surface of the windings. It is understood that such means may indicate, for example, one or more rollers, belts, etc. Therefore, the expression "friction driving means" will be used.

(b) Reservoir reel 1.

(c) Take-up reel 2.

(d) "Energy-consuming means 36 applied to reservoir reel 1. Said means may be, for example, mechanical friction, magnetic, hydraulic, pneumatic brake, etc.

It is understood that the reels and/or driver

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roller are so supported (and if necessary provided with springs or other suitable means) as to maintain frictional contact between each reel and the driver while the diameter of winding surfaces on the reels is changing during winding.

In Fig. 6 one more element is added to those of Fig. 5:

(e) Guiding reel supports 38 oriented at an angle F and wire guide 39 oriented at an angle G.

Such guides are so oriented as to provide (due to the action of friction forces T_1 and T_2 an increase of compression between the driver and reel 2 ("draw-in") and decrease of tension between the driver and reel 1 ("throw-out"), while the wire is wound in the sense indicated by the arrow B. Hereinafter such reel supports will be referred to as "force-responsive supports."

Such an arrangement will provide a winding process having a marked self-stabilizing property. Naturally the values of all frictions, guide directions and other variables must be properly selected and adjusted, taking into account also resistance 35.

The guiding means 39 may have a form of a slot as shown in Fig. 6 or a rocker arm 3 as (in Fig. 1) or any other form suitable for the purpose described.

While the embodiments of Figs. 5 and 6 show the elements of a device for reeling in only one direction, by using on both reels symmetrically the same elements, a device for reeling in both directions is obtained. This can be done, for example, as shown in Figs. 1 and 2, wherein each reel is provided with "direction-responsive" energy-consuming means, i. e., brakes that would operate selectively only when that reel is unwinding. To further increase the stability of loop tension, it will be seen that each reel is provided with force-responsive supports, in this case making the loop tension also a function of process resistance 35 in conjunction with the "draw-in" and "throw-out" action of the reel supports.

In addition, each of the above embodiments can be provided with adjustable pressure producing means (13 and 13', Fig. 1), self-regulating friction brakes, such as shown in Figs. 3 and 4, and other details and refinements pertinent to the given particular use of the device.

In the above specification and drawing an embodiment of this invention was shown in which the wire can be wound alternately in both directions; it is obvious however, that the same principle and mechanical features can be applied to a device where the wire is wound only in one direction.

In the present system the total energy consumed by the friction is supplied by the driving roller and is conveyed to the take-off reel, mostly through the direct contact between the driving roller and the take-off reel and only partially through the wire itself. This makes it clear why with such a system it is possible to obtain any controllable large or small amount of tension in the wire while the device is in operation and at the same time overcome the inertia of the reels directly through the contact with the winding surface without involving the wire loop in such process.

It is to be understood that while typical embodiments of this invention have been shown here, this is for illustrative purposes only and various changes in design, structure and arrangement may be made without departing from the spirit and scope of the invention or of the appended claims.

Furthermore, the scope of the present invention is not intended to be limited to the illustrated case of wire heat treating device, since the device of this invention with its characteristic features and advantages can be applied in many other processes, some of which have been mentioned above.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. In a wire reeling device a supporting frame, reservoir and take-up reels onto which the wire is wound mounted on said frame, a pair of rocker arms, said reels being rotatably supported on shafts fixed respectively in said rocker arms, said rocker arms being pivoted on said frame so that all of said shafts and pivots are parallel, a driving roller having its shaft parallel to each said reel shaft and in frictional engagement with the winding surface of said reels, said rocker arms being so mounted as to provide "draw-in" and "throw-out" action of said reels, while each reel draws or releases the wire respectively, said reels being provided with friction elements connected to said reels by direction responsive clutches, each of said reels selectively engaging its friction element through its clutch when the wire is being unwound from that reel.

2. In a wire reeling device a supporting frame, reservoir and take-up reels onto which the wire is wound, said reels being rotatably supported on shafts fixed on rocker arms, said rocker arms being pivoted on said frame so that all of said shafts and pivots are parallel, a driving roller having its shaft parallel to said reel shaft, said rocker arms being resiliently biased to maintain friction engagement between the winding surface of said reels and said driving roller, said rocker arms being pivoted to provide "draw-in" and "throw-out" action of said reels, while each reel draws or releases the wire, said reels being provided with friction elements connected to said reels by direction responsive clutches, each of said reels selectively engaging its friction element through its clutch when the wire is being unwound from that reel, said friction elements being composed of two mating friction members, one of which is attached to said clutch while the second is supported independently from the reel by means of a torque-responsive adjustable and self-regulating device adapted to maintain constant average torque limited by said adjustment.

3. A wire reeling device comprising a supporting frame, a driving roller mounted for rotation on said frame, a pair of rocker arms pivotally mounted on said frame, a reservoir reel rotatably mounted on one of said rocker arms from which the wire being reeled is to be drawn, a take-up reel rotatably mounted on the other of said rocker arms on which the wire being reeled is to be wound, resilient means urging each

of said reels into frictional contact between the winding of each reel and the driving roller, and means applying a drag torque to said reservoir reel whereby a desired tension can be produced in the wire being drawn off said reservoir reel by apportioning the amount of energy supplied from said driving roller to said reservoir reel with respect to the amount of energy supplied to said reservoir reel by tension in said wire.

4. A wire reeling device as in claim 3 further including means for reversing the direction of rotation of the driving roller to reverse the directions of rotation of said reels, means for rendering said drag-torque-providing means ineffective when the direction of the rotation of said reservoir reel is reversed, and means applying a drag torque to said take-up reel only when rotating in said reverse direction.

5. A wire reeling device as in claim 4 wherein the angle between the line joining the axes of said drive roller and each of said reels with respect to the line joining the axis of each reel with its corresponding rocker arm pivot exceeds 90 degrees.

6. A wire reeling device as in claim 5 wherein said angle is between 90 and 150 degrees.

7. A wire reeling device comprising a driving roller, a first reel, a second reel, means resiliently urging said roller against the windings on said reels to drive said reels by frictional engagement with said roller, means for reversing the direction of said roller, a self-regulating energy-consuming friction device coupled to each reel for providing a drag torque thereon, and a direction-responsive clutch connecting each such friction device to its respective reel for disengaging the friction device for the reel being wound upon.

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