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WIRE TENSIONING FILAMENT FEEDING APPARATUS

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2 Sheets-Sheet 1

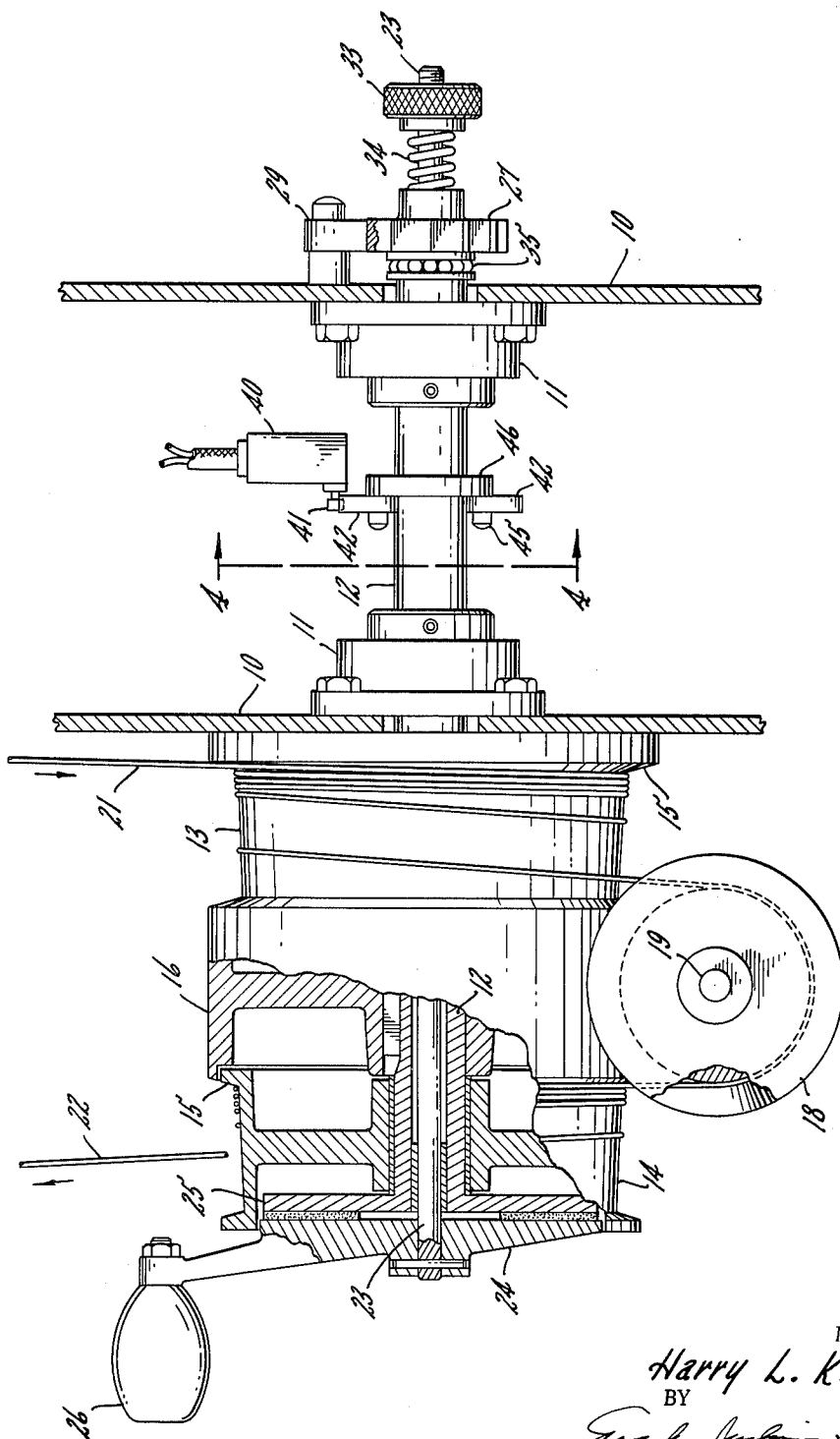


FIG. 1.

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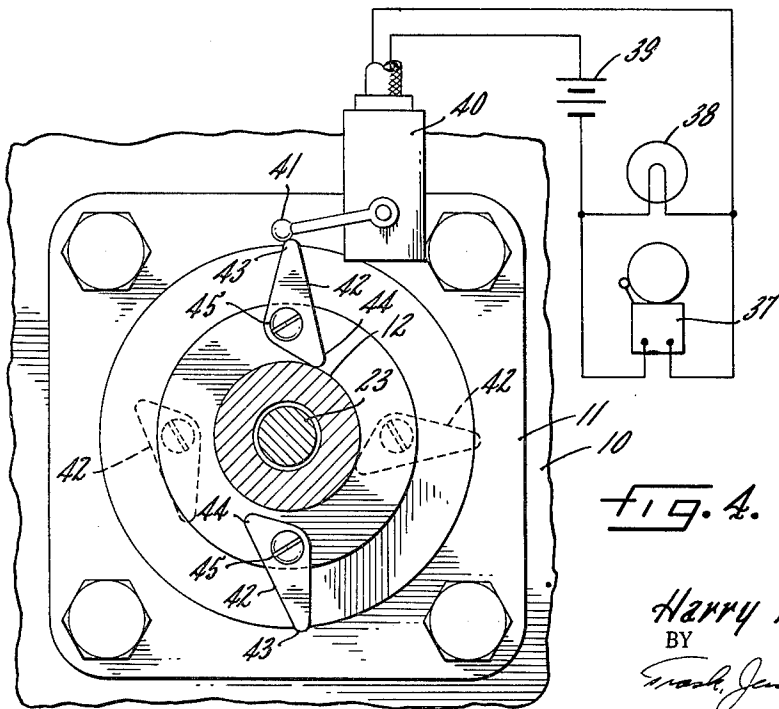
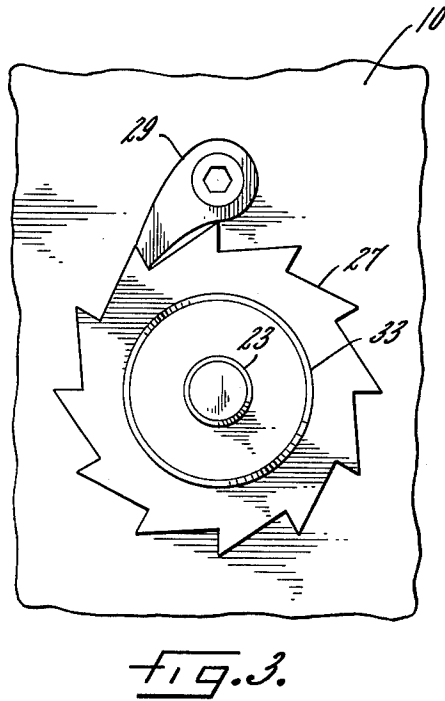
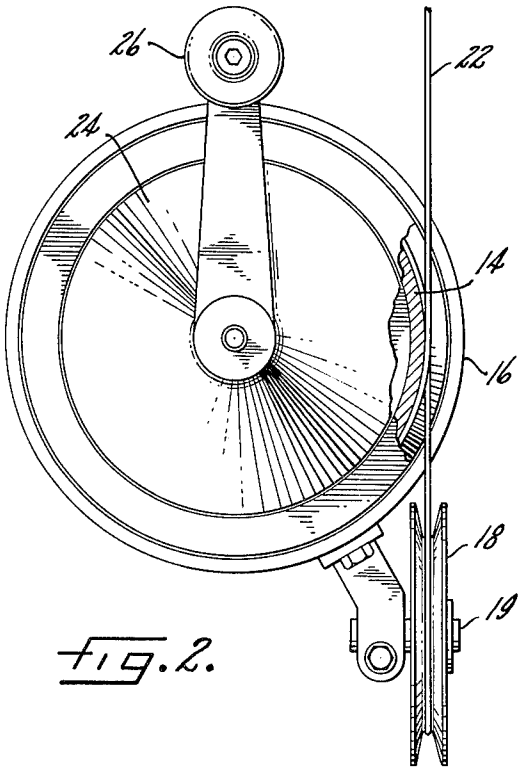
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2 Sheets-Sheet 2



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## WIRE TENSIONING FILAMENT FEEDING APPARATUS

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8 Claims. (Cl. 242—47.12)

In the continuous processing of wire drawn under tension over a predetermined path, it is frequently desirable to provide at one or more points along such path a device, known as an accumulator, which is capable of storing a quantity of the moving wire and of paying it out should the wire entering into association with the accumulator be stopped or subjected to excessive drag. A known form of accumulator comprises a pair of similar coaxial, relatively rotatable, tapered drums each capable of storing a plurality of turns of moving wire. The two drums are arranged with the smaller end of one adjacent the larger end of the other, and between the two there is disposed a coaxial rotatable idler-carrier rotatably supporting an idler disposed in a plane approximately tangent to the wire-receiving surfaces of the drums. The entering wire is fed to the larger end of that drum whose larger end is remote from the idler carrier, passes several times around that drum, and thence around the idler. From the idler the wires passes to the larger end of the other drum, about which it is wrapped for several turns in a direction opposite to that followed around the first drum. If the idler-carrier is held against rotation, wire will enter and leave the accumulator at the same rate and the amount of wire stored on the two drums will remain constant. However, if the idler-carrier is permitted to rotate as a result of the effort applied to it by tension in the wire stretches respectively entering and leaving the idler, wire will be drawn into the accumulator at a speed below that of the departing wire, and the amount of wire stored on the two drums will decrease. By employing a slippable brake to hold the idler-carrier stationary the accumulator may be made to serve as a tension limiter; for if movement of the entering wire is stopped or retarded by excessive drag on it, the resultant increase in tension in the wire may cause the brake to slip, thus permitting the idler-carrier to rotate and allow the speed of wire pay-out to be maintained as the stock of wire on the drums is depleted. After such an occurrence, and after the entering wire has been released or relieved of excessive drag, the stock of wire on the drums can be replenished by forcibly rotating the idler-carrier in the reverse direction while maintaining tension in the departing wire.

This application is directed to improvements in an accumulator of the general type just described. In accordance with one feature of the invention the idler-carrier is connected through an adjustable friction clutch to a rotatable operating shaft operatively associated with which is a ratchet or like device holding the shaft against rotation in the direction in which the idler-carrier is urged to rotate by tension in the wire. Since the ratchet prevents rotation of the shaft in that direction and since the shaft is connected to the idler-carrier through the clutch, the idler-carrier is held stationary until wire-tension rises to a point where the clutch slips, whereupon the idler-carrier rotates to permit the continued pay-out of wire and prevent any further increase in wire-tension. When it becomes necessary to replenish the stock of wire on the drums, the operating shaft is rotated, as freely permitted by the ratchet, to rotate the idler-carrier in the stock-replenishing direction. In such rotation, the idler-carrier is driven through the clutch, which func-

tions to limit the tension that can be imposed on the wire by rotation of the operating shaft.

In accordance with another feature of the invention a warning device or alarm is associated with the idler-carrier to give a visual or audible indication whenever the idler-carrier is rotating in the stock-depleting direction. Preferably, such device is so constructed and arranged as to be inoperative on rotation of the idler-carrier in the opposite direction.

Other objects and features of the invention will become apparent from the following more detailed description and from the accompanying drawings, in which:

FIG. 1 is a front elevation of an accumulator with parts thereof broken away and showing in section;

FIG. 2 is an end elevation, on a reduced scale, taken from the left-hand end of the accumulator as shown in FIG. 1;

FIG. 3 is a fragmental elevation of the opposite end of the accumulator; and

FIG. 4 is a vertical section on the line 4—4 of FIG. 1.

The accumulator shown in the drawing comprises a frame including a pair of vertical plates 10 through and beyond which a hollow shaft 12 extends. The shaft 12 is rotatably supported from the plates 10, desirably through the medium of antifriction bearings 11. One projecting end of the shaft 12, the left-hand end in FIG. 1, supports two axially spaced drums 13 and 14, each of which is independently rotatable on the shaft 12 and is adapted to contain a plurality of wire-turns. These drums have the conventional form of drums adapted, in rotation, continuously to receive and discharge the moving wire while storing a plurality of wire-turns in a single layer. That is, each drum has a slightly tapered wire-receiving surface and is provided at the larger-diameter end of such surface with a flange 15 having a sloping inner face which is engaged by the entering wire to exert thereon a camming action forcing wire turns previously deposited on the drum to move toward the smaller end thereof and thus make room for the entering wire.

Fixed to the shaft 12 between the drums 13 and 14 is a support 16 for an idler sheave 18. Such sheave, as will be clear from FIG. 2, is disposed in a plane generally tangent to the wire-receiving surfaces of the drums 13 and 14 and is freely rotatable about the axis of a shaft 19 carried by the support 16 to reverse the direction of wire leaving one drum and guide it to the other drum. It is assumed in the drawings that wire, indicated at 21, will enter into association with the accumulator from above in FIG. 1, will be guided into engagement with the flange 15 of the drum 13 at the near side thereof in FIG. 1, which is the right-hand side in FIG. 2. Then, after passing several times around that drum, the wire will be guided by the sheave 18 into engagement with the inclined face of the flange 15 of the drum 14 to pass several times around that drum and leave the accumulator in an upward direction as shown at 22 in FIGS. 1 and 2. In conformity with that assumption, the drums are shown as so disposed that the flange 15 of drum 13 is remote from, and the flange 15 of drum 14 adjacent, the carrier 16.

Extending through and rotatably supported within the hollow shaft 12 is a central shaft 23 to the outer end of which is fixed a disk-like clutch member 24 adapted to bear frictionally against a cooperating clutch member 25 rigid with the adjacent end of the shaft 12. One of the clutch members is desirably faced with friction-increasing material; and the clutch member 24 is provided with a handle 26 adapting it and the shaft 23 for manual rotation.

At its opposite end, the central shaft 23 projects beyond the shaft 12 into association with both an adjustable

means insuring contact between the interengaging faces of the clutch members 24 and 25 and a means for limiting the shaft to one direction of rotation. As shown, the latter means comprises a ratchet-wheel 27 rigidly secured to the shaft 23 to cooperate with a pawl 29 pivotally mounted on the frame of the machine.

The means shown for maintaining contact between the interengaging faces of the clutch members 24 and 25 comprises a manually adjustable nut 33 screw-threadedly mounted on the end of the shaft 23 to act against a compression spring 34 interposed between the nut and the ratchet wheel 27. Desirably, an antifriction thrust bearing 35 is interposed between the hub 28 of the ratchet wheel and the adjacent end of the shaft 12.

It will be understood that, in use, the accumulator will be operatively interposed between a means (not shown) which imposes a drag on wire entering the accumulator and a second means (also not shown) which, by applying tension to the wire leaving the accumulator, causes the wire to be fed. Under normal conditions, the carrier 16 will be stationary and the wire will enter the drum 13 at the larger end thereof as above described, pass several times around that drum in a clockwise (FIG. 2) direction and over the sheave 18 to the larger end of the drum 14, and will leave the accumulator after passing several times around that drum in a counterclockwise direction. Thus, as the wire feeds, the drum 13 will be rotated in a clockwise direction (FIG. 2) and the drum 14 in the opposite direction. Tension in the wire will apply counterclockwise (FIG. 2) torque to the carrier 16, which torque will be resisted by an opposite torque applied to the carrier from the frame of the machine through the pawl 29, ratchet wheel 27, shaft 23, clutch 24-25, and shaft 12. Should excessive drag imposed on the entering wire 21 raise torque applied to the carrier 16 to a point such as will cause the clutch 24-25 to slip, the carrier will rotate in a counterclockwise direction to cause, in effect, an unwinding of wire from both drums, thereby permitting delivery of wire from the accumulator to continue at undiminished rate while the entering wire decelerates or stops completely, depending upon the effect of the increased drag imposed on it. The accumulator therefore operates as a tension-limiter to limit tension in the wire to that which will cause slippage of the clutch 24-25. The tension required to slip the clutch 24-25 can be varied as desired by adjustment of the nut 33 which, by varying stress in the spring 34, determines the pressure acting between the interengaging faces of the clutch members 24 and 25.

As just indicated, slipping of the clutch 24-25 and consequent rotation of the carrier 16 depletes the stock of wire on the drums 13 and 14. That stock can be replenished in known manner, by manual rotation of the carrier 16 in the clockwise direction, such rotation being effected by manual effort applied to the handle 26 of the clutch member 24. It will be noted that rotative effort applied to the handle 26 is transmitted to the carrier through the clutch 24-25, which therefore serves as a tension limiter during the replenishing operation as well as in normal operation of the accumulator. Rotation of the shaft 23 in the replenishing operation is freely permitted by the ratchet 27, so that the rotative effort to be applied to the clutch member 24 is only that necessary to overcome tension in the entering wire.

As will be apparent, the accumulator described can act as a tension-limiter only so long as a stock of wire remains on the drums 13 and 14. I may, therefore, provide the accumulator with a warning device which will give a visual and/or audible signal when the carrier 16 begins to rotate in the counterclockwise direction which, if continued, would result in exhausting the stock of wire on the drums. Preferably, such warning device is so constructed that it is operative only on counterclockwise rotation of the carrier 16 so that it will not operate to produce any disturbing signal when the carrier is being

manually rotated in the reverse direction to replenish the stock of wire on the drums.

A signalling device for accomplishing the object just mentioned is illustrated in FIGS. 1 and 4. The device there shown comprises an electric bell 37 and an electric lamp 38 adapted to be connected to a battery 39 or other current-source by a switch 40. Such switch, which is normally open, has an operating arm 41 disposed to be engaged by one or more dogs 42 supported from the shaft 12. Each of the dogs is conveniently in the general form of an obtuse-angled, scalene triangle having a tip 43 and a tail 44 and pivotally mounted through a screw 45 on the side face of a collar 46 secured to the shaft 12. Each dog 42 is freely swingable about its pivotal screw 45 under the influence of gravity except as limited by its engagement with the shaft 12. Each dog is so shaped that its rotation in a clockwise direction about the screw 45 is limited by engagement of the tail 44 with the shaft 12 to a generally radial position, shown in full lines in FIG. 4, in which the tip 43 of the dog will, as the shaft 12 and collar 46 rotate, actuate the switch-arm 41 to close the switch 40. From the radial, full-line position shown in FIG. 4, each dog can rotate about its pivot screw 45 in a counterclockwise direction into a generally tangential position where its tip 43 would clear the switch-arm 41 in rotation of the shaft 12. Irrespective of the direction in which the shaft 12 and collar 46 may rotate, a dog passing through the six-o'clock position with respect to the shaft 23 will hang downwardly with its tail 44 in or near engagement with the shaft 12. If the rotation of the shaft 12 and collar 46 is in the counterclockwise direction, engagement of the tail 44 with the shaft 12 as the dog leaves the six-o'clock position will hold the dog extending outwardly as indicated in dotted lines at three-o'clock in FIG. 4. In clockwise rotation of the shaft 12, a dog leaving the six-o'clock position will swing into the tangential position before it passes the switch arm 41 and will remain tangentially disposed through the twelve-o'clock position to clear the switch-arm. Thus, in clockwise rotation of the shaft 12 the switch arm will not be engaged by the dogs 43; but when the shaft 12 rotates in the opposite direction the switch-arm will be intermittently engaged by the dogs passing it to effect intermittent operation of the signals 37, 38.

When, in the feeding of wire, the tension therein reaches the point where the clutch 24-25 slips, the carrier 16 will begin to rotate in the counterclockwise direction, the dogs 42 will repeatedly operate the switch 40 to actuate the signals and thus give a warning that the stock of wire on the drums 13 and 14 is being depleted. Advised by the signals of that condition, an operator can take steps to remedy it and replenish the stock of wire on the drums in the manner above described.

While I have described my accumulator and its operation with reference to wire, it will be obvious and is to be understood that it is equally adapted for use with other continuous filamentary material. It is likewise to be understood that although I have referred to the two co-operating members 24, 25 as constituting a clutch they function as a brake when the shaft 23 is held against rotation.

I claim:

1. In an accumulator having two coaxial, freely and independently rotatable drums each adapted to contain a plurality of turns of a continuous, longitudinally moving filament, an idler carrier coaxial with said drums, located therebetween, and rotatable relatively thereto, an idler mounted on said carrier in position to receive filament leaving one drum, reverse its direction, and guide it so reversed on to the other drum, whereby the moving filament will rotate the drums oppositely to each other and tension in the filament will tend to rotate said carrier in one direction, a rotatable operating shaft, slippable clutch means operatively interconnecting said operating shaft and carrier and transmitting torque therebetween, and means

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operatively associated with said operating shaft for opposing its rotation under the influence of said torque while permitting it to be rotated in the other direction.

2. An accumulator as set forth in claim 1 with the addition that said clutch means is adjustable to vary the torque required to cause it to slip.

3. An accumulator as set forth in claim 1 with the addition of signalling means operative to signal rotation of said carrier in said one direction but inoperative to signal rotation of the carrier in the opposite direction.

4. An accumulator as set forth in claim 1 with the addition of signalling means operative to signal rotation of said carrier in said one direction.

5. An accumulator as set forth in claim 1 with the addition of a hollow shaft rigid with said carrier and extending through said drums, said operating shaft being located within said hollow shaft, said clutch means including a pair of cooperating friction clutch members rotatable respectively with the hollow shaft and operating shaft, and adjustable means forcing said clutch members into frictional interengagement.

6. An accumulator as set forth in claim 5 with the addition that said operating shaft projects beyond both ends of said hollow shaft, said clutch members being located at one end of the hollow shaft and said adjustable means acting between the opposite end of the hollow shaft and the adjacent end of the operating shaft.

7. In an accumulator having two coaxial, freely and independently rotatable drums each adapted to contain a plurality of turns of a continuous, longitudinally moving filament, an idler carrier coaxial with said drums, located therebetween, and rotatable relatively thereto, an idler mounted on said idler carrier in position to receive filament leaving one drum, reverse its direction, and guide it so reversed on to the other drum, whereby the moving

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filament will rotate the drums oppositely to each other and tension in the filament will tend to rotate said carrier in one direction, slippable brake means opposing rotation of the carrier in said one direction, and signalling means operative to signal rotation of the carrier in said one direction but inoperative to signal rotation of the carrier in the opposite direction.

8. In an accumulator having two coaxial, freely and independently rotatable drums each adapted to contain a plurality of turns of a continuous, longitudinally moving filament, an idler carrier coaxial with said drums, located therebetween, and rotatable relatively thereto, an idler mounted on said carrier in position to receive filament leaving one drum, reverse its direction, and guide it so reversed on to the other drum, whereby the moving filament will rotate the drums oppositely to each other and tension in the filament will tend to rotate said carrier in one direction, slippable brake means opposing rotation of the carrier in said one direction, and signalling means operative to signal rotation of the carrier in said one direction.

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