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[54] CREEL FOR ROTATABLE BOBBINS

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[51] **Int. Cl.** **B65h 59/38,** B65h 59/04

[58] **Field of Search**.....242/156, 156.2, 45, 75.1, 75.5, 242/75.42

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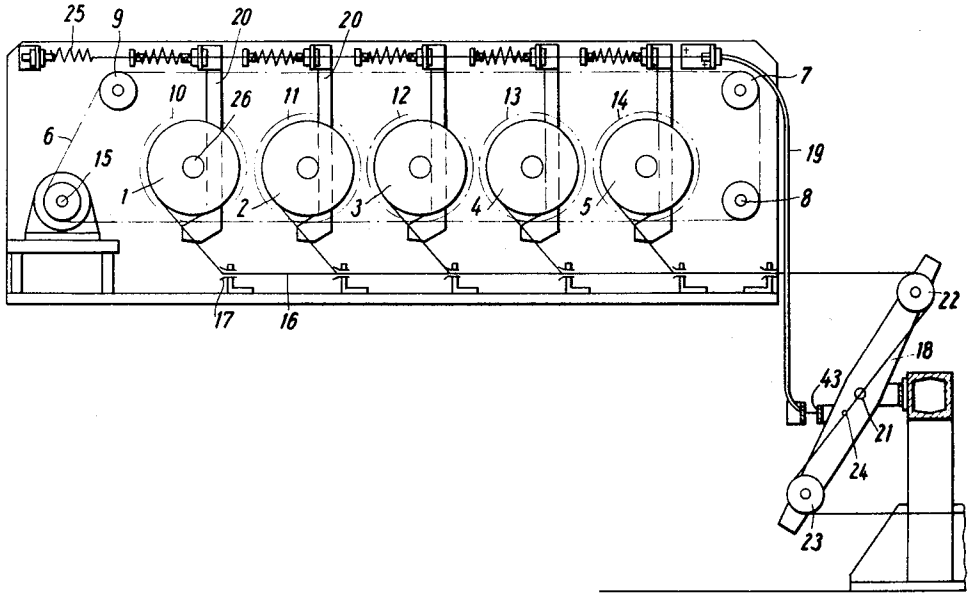
[57] **ABSTRACT**

A creeling device having a plurality of bobbins mounted for rotation, each bobbin being under the control of its individual tension detecting means so that the bobbin is driven when the tension of its strand is too high and is retarded when the tension of its strand is too low. Means is provided for stabilizing the mechanism by selectively driving and retarding the bobbins, whereby the regeneration of tension disturbances in the system is avoided.

9 Claims, 5 Drawing Figures



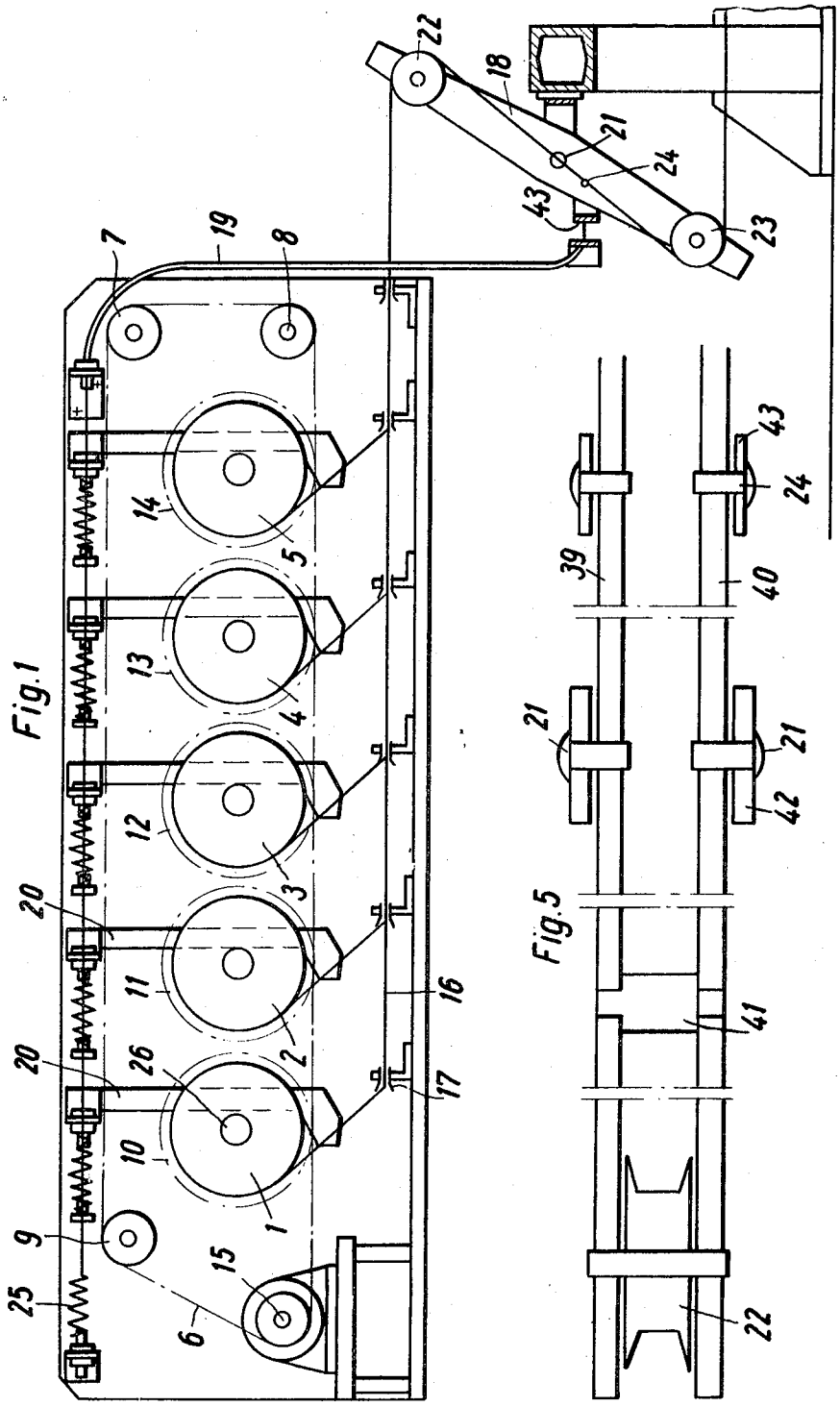


Fig.1

Fig.5

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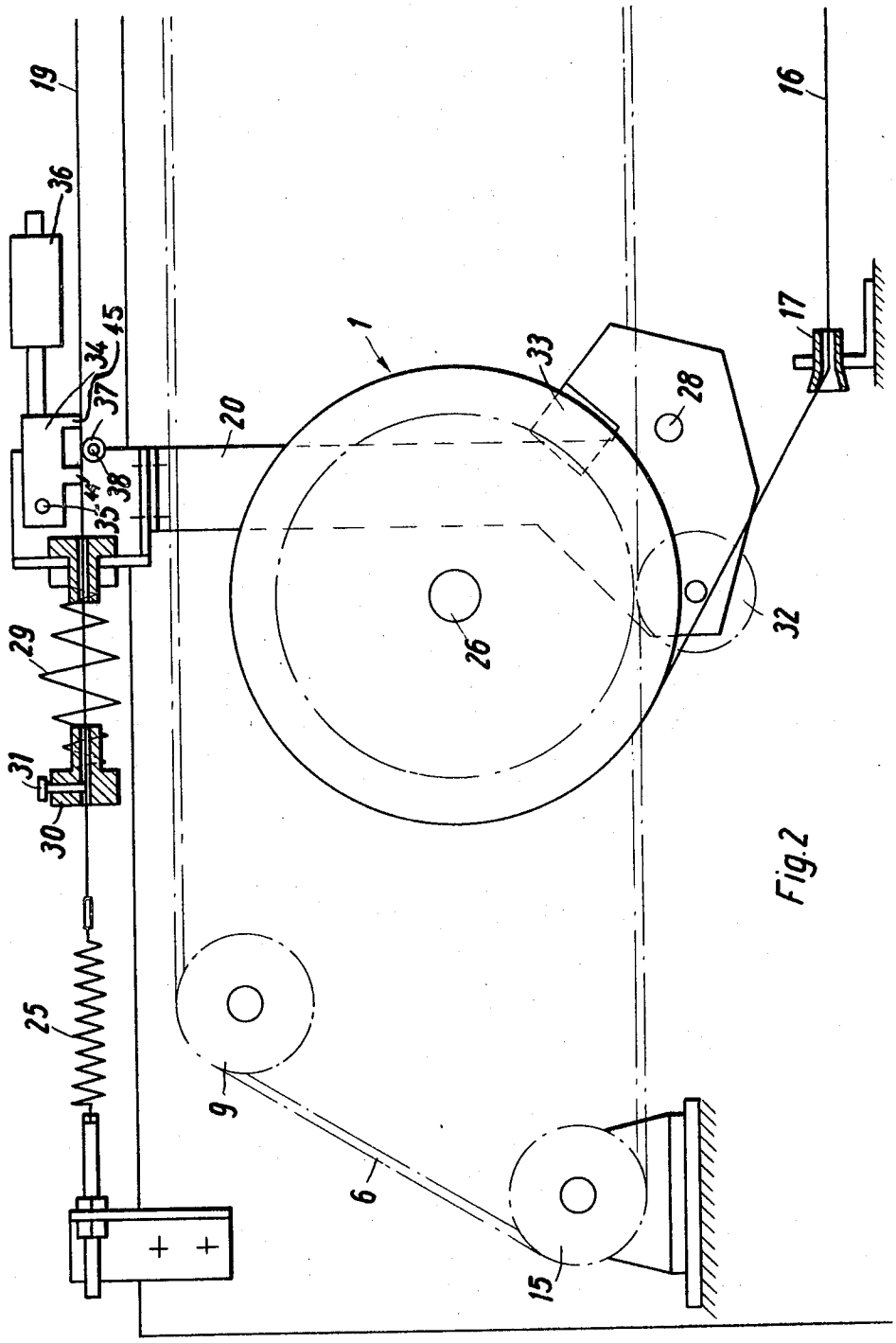

Fig.2

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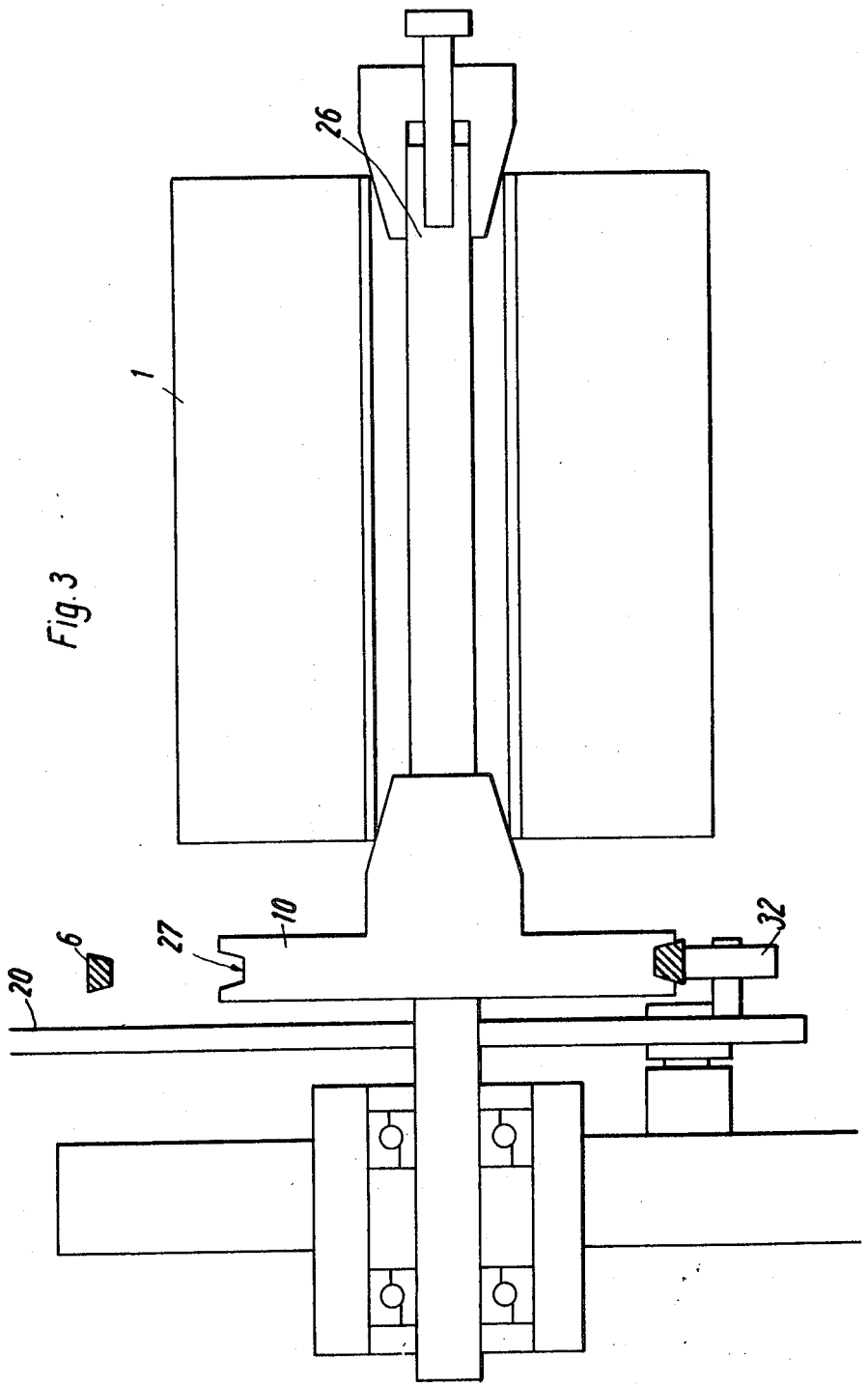

Fig. 3

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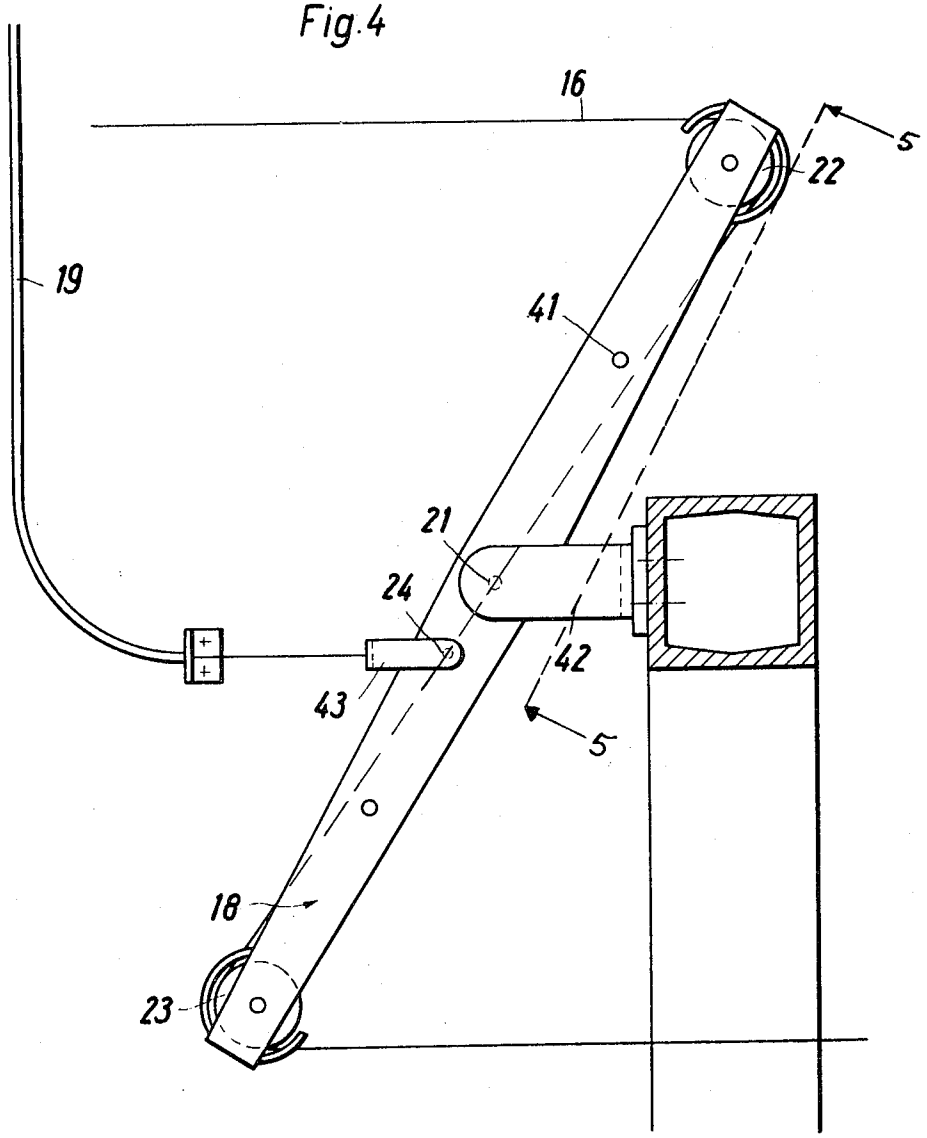
Fig.4



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CREEL FOR ROTATABLE BOBBINS

This invention relates to a bobbin mounting device, or creel, for the paying out of strands by peripheral unwinding from the bobbins.

It is possible to pay out strands from bobbins on which it is wound in two different ways: (1) by withdrawal along the axis of the bobbin, and (2) by peripheral unwinding from the bobbins. Each of such methods has its advantages and disadvantages. In method (1), the bobbin is fixed and the strand may be withdrawn at a very considerable speed without having the very small tension in the strand substantially affected. In method (2), the bobbin is mounted for rotation about its axis and turns about such axis. The tension of the strand depends upon a number of factors including the inertia of the bobbins, and variations in the speed of withdrawal of the strand. Method (1) imposes one twist per turn of strand on the bobbin as the strand is paid off, whereas method (2) does not impose any twist on the strand as it is unwound from the bobbin.

It is therefore necessary to use method (2) when it is not possible to use a twisted strand. Such is the case, for example, when a plurality of thin parallel strands are to be employed in the reinforcement of sheets of plastic material. In such case the strands must be disposed as nearly as possible in a plane, which is impossible if the strands are under torsion.

Since one can not synchronize the rotation of two or more bobbins in the case of unwinding in accordance with method (2), (this can be done in method (1)), there are used in method (2) bobbins which are large enough to eliminate very frequent stoppages of the bobbins. Because the bobbins have considerable inertia, the strand may break when the speed of paying out of the strand varies too abruptly. Further, in certain cases, such as the reinforcement of plastic by filaments embedded therein, the tension in the strands should be low in order to facilitate the impregnation of the strand by the plastic.

These two results—small constant tension in spite of variations in the speed of paying out the filament—are obtained in method (1) but not by prior apparatus operating in accordance with method (2).

It is accordingly among the objects of the present invention to provide a creel for bobbins from which filaments are removed in a peripheral direction which provide a constant low tension in the strand being delivered despite changes in the speed of such delivery.

The creel in accordance with the invention, which supports one or more bobbins, has means for rotatably driving the bobbin, means sensitive to the tension of the strand, and a pivotally mounted control lever provided with means selectively to couple the bobbin to the driving means. The lever is subjected, through the intermediary of a connecting linkage, to the response of the tension sensitive means in such manner as to pivot the lever into a bobbin—driving position when the tension of the strand exceeds a predetermined desired value. In a preferred embodiment of the creel in accordance with the invention, the control lever is also provided with a brake which cooperates with the bobbin when the control lever pivots into a braking position under the effect of the tension sensitive means when such means detects too low a tension in the strand.

Preferably an endless V or trapezoidal belt is employed as the bobbin driving means, there being a pulley fixedly connected to the bobbin and having a peripheral groove receiving the belt. The run of the belt at the pulley is such that unless the belt is pressed toward the pulley it does not engage and drive it. The coupling means comprises a roller which when the control lever is pivoted into driving position presses the belt into the groove in the pulley so as to provide a slipping coupling between the belt and pulley, the force with which the roller is pressed against the belt being a function of the tension of the strand.

The linkage is advantageously made up of a cable which is connected at one zone thereof to the tension sensitive means and at another zone thereof to a part of a fixed frame, there being a tension spring interposed in series in the cable adjacent to the frame. A first end of the lever, remote from its pivotal axis, is connected to the cable by means of a second spring which transforms the movement of longitudinal displacement of the cable into a pivotal movement of the lever.

Another important characteristic of the invention resides in the fact that the creel includes a stabilizer mechanism comprising a brake shoe which is pivotally mounted on the end of the lever that is connected to the cable; the brake shoe, which is subjected to the action of a weight, is applied to the cable which is backed up at that point by a small roller. The force with which the brake shoe is applied to the cable is such as to reduce the accelerations of the control lever, thereby avoiding regenerative effects in the system.

Other characteristics and advantages of the invention will appear in the course of the description below of a perfect embodiment of creel in accordance with the invention which is shown in the attached drawings in which:

FIG. 1 is a view in side elevation of a creel provided with five bobbins;

FIG. 2 is a view partially in side elevation and partially in vertical longitudinal section of a bobbin and its associated control means, FIG. 2 being on a larger scale than FIG. 1;

FIG. 3 is a view in vertical axial section through a bobbin and its driving pulley;

FIG. 4 is a detail view of the oscillating arm which forms a part of the tension sensitive means; and

FIG. 5 is a fragmentary view in elevation of the oscillating arm of FIG. 4, the view being taken from the line 5—5 of FIG. 4.

In FIG. 1 reference characters 1–5, inclusive, designate five bobbins mounted on the creel. The bobbins are selectively rotatably driven by an endless belt 6 which in this instance is of trapezoidal section, such belt passing in succession around idle pulleys 7 and 8, a driven pulley on a motor shaft 15 and an idle pulley 9. The run of the belt 6 between the idle pulley 8 and the motor pulley is such that when the belt is not pressed toward the pulleys connected to the bobbins such run lies in a plane which is tangent to the outer surface of the pulleys 10–14, inclusive, which are associated with the respective bobbins 1–5, inclusive. In such position of the belt it does not drive the pulleys.

The strand 16 of the bobbin 1 passes through a guide 17 and thence to a tension sensitive means formed in part by an oscillatory arm 18. It will be understood that each of the strands from the respective bobbins passes through its guide 17 into its individual tension sensitive means, the various strands leaving the tension sensitive means being disposed in parallel relationship. A cable 19 is provided for each of the tension sensitive means, each such cable connecting its tension sensitive means to a respective control lever 20.

The oscillatory arm 18 is mounted for pivotal movement about a central transverse shaft 21. The arm 18 carries a roller 22, 23, at each end, the respective strand 16 passing over and partially about the roller 22 thence downwardly to pass partially about and under the roller 23. Turning of the arm 18 about the cross shaft by the thus formed loop in strand 16 is opposed by a coil tension spring 25, to be described. It is apparent that upon an increase in tension in the strand 16 the arm 18 rotates counterclockwise (FIG. 1) and then upon a decrease in tension in the strand 16 the arm 18 rotates clockwise. The cable 19 is attached by a stirrup 24 pivotally attached to the arm 18 eccentric of the pin 21; the cable 19 passes through a tubular sheath in the portion thereof shown at the right in FIG. 1, the upper and lower ends of the sheath being connected to fixed parts of the frame. The cable 19 for the bobbin 1 extends from the upper end of its sheath longitudinally of the creel, past the point of its connection to the lever 20 for the bobbin 1, to be connected to the above-mentioned coil tension spring 25. The spring acting through the cable 19 tends to lengthen the loop formed by the rollers 22, 23, by urging the arm 18 clockwise.

In FIGS. 2 and 3 there are shown in detail the mechanisms associated with bobbin 1. It will be understood that similar mechanisms are employed with each of the other bobbins in the creel.

Bobbin 1 is mounted upon opposed conical elements mounted upon a shaft 26 as shown in FIG. 3. A pulley 10, affixed to shaft 26, has an annular groove 27 therein, such groove being of trapezoidal section so as selectively to receive the belt 6. The control lever 20 is pivotally mounted upon a stub shaft 28 (FIG. 2) adjacent one end of the lever; the other end of the lever is connected to the cable 19 through the medium of a spring 29. The presence of the spring permits the cable 19 to move further than the end of lever 20 to which it is attached, while transforming the longitudinal movement of the cable into the pivotal movement of the lever. One end of spring 29 is attached to a sleeve-like block 30 which may be secured to the cable by a set screw 31. The other end of spring 29 is attached to a second sleeve-like fitting attached to the upper end of lever 20. The spring 29 functions both in tension and compression between block 30 and the upper end of lever 20, as will be explained below.

Near the stub shaft 28 and on opposite sides thereof the lever 20 carries a roller 32 journalled thereon and a brake shoe 33, the roller 32 and the brake shoe 33 being disposed in the plane of the groove 27 in the pulley 10. When the cable 19 is pulled to the right (FIG. 2) by a tension in strand 16 which is higher than that desired, the spring 29 is compressed, whereby to turn the lever 20 clockwise so that the roller 32 thrusts the belt 6 into the groove 27 as shown in FIG. 3. The bobbin 1 is thus then rotatably driven by the belt, thereby to increase the speed of paying out of the strand from the bobbin. The belt 6 and pulley 10 cooperate to form a slip clutch, the pulley being driven at a greater speed when the roller 32 presses the belt 6 into the groove 27 of the pulley 10 with greater force. It will be understood that the speed at which the belt 6 is driven is constant, and that it is always somewhat greater than that necessary to supply the strand at the maximum required rate, no matter how much of the strand remains on the bobbin, that is, the effective diameter of the bobbin.

When, on the other hand, the tension of the strand 16 is too low and the arm 18 is rotated counterclockwise by the spring 25, the spring 29 pulls the upper end of control lever 20 to the left (FIG. 2) and thus rotates the lever counterclockwise. The brake shoe 33 is then introduced into the groove 27 in the pulley 10, whereby to retard the rotation of the bobbin and thus to raise the tension of the strand. The efficiency of the assembly is remarkable, especially in view of the simplicity of the means employed.

In the preferred embodiment of apparatus shown, there is provided a stabilizer to eliminate "hunting" or disturbance regeneration which could seriously change the speed of feeding of the strand from the desired constant speed. The stabilizer, which is shown in FIG. 2, includes a brake shoe 34 which is mounted on the fitting attached to the upper end of lever 20 by a pivot pin 35 parallel to the stub shaft 26. Extending generally horizontally from the brake shoe 34 in a direction opposite the spring 29 and block 30 is an arm having a weight 36 adjustably mounted thereon, the weight 36 urging the brake shoe 34 clockwise so that its two longitudinally spaced fingers 44, 45 engage the cable 19. Between fingers 44, 45 there is a roller 38 journalled on a stub shaft 37 on the lever 20. The roller 38 holds the cable 19 at a fixed height, thus to prevent its deflection by the fingers 44, 45.

The stabilizer functions to anticipate accelerations in the apparatus. The stabilizer is in effect sensitive to variations in the speed of the cable or of the position of the control lever 20. It reacts upon the lever 20 to drive it in the same direction as the spring 29 or in the opposite direction depending upon the direction of variation of such speed.

If the speed of delivery of the strand is insufficient, the cable 19 moves to the right (FIG. 2), driving the lever 20 in such direction as to accelerate the bobbin. The brake shoe 34 through its engagement with the cable 19 drives the lever 20 in the same direction. When the speed of turning of the lever 20 decreases because the speed of the cable 19 decreases, the brake shoe 34 retards the pivoting of the lever 20; during such time, the spring 29 continues to push the lever 20 until the cable 19 ceases to move. It can thus be said that the stabilizer detects in advance that the speed of paying out of the strand will be sufficient and prevents any substantial movement of the lever 20 which would require a subsequent correction in the opposite direction and would thus produce "hunting."

If, on the other hand, the speed of paying out of the strand is too high, the stabilizer accompanies the action of spring 29 in pivoting the lever 20 in the opposite direction about its axis. But when the tension of the strand again begins to increase, the brake shoe 34 retards the movement of the lever 20 by imposing a force upon it in the direction opposite from spring 29.

FIGS. 4 and 5 show in detail a preferred construction of the arm 18 and the mechanism associated with it. The arm 18 is composed of two parallel strips 39, 40 connected by cross pieces 41. The pivot shaft 21 mounting arm 18 is composed of two opposed trunnions mounted in a fixed bracket 42. The lower, forward end of cable 19 is attached to a U-shaped bracket 43 which is pivotally connected to the arm 18 by two opposed trunnions 24.

Although the invention is illustrated and described with reference to a preferred embodiment thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a preferred embodiment, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. An arrangement for paying out strands peripherally from a plurality of bobbins, comprising in combination, a support frame, a plurality of bobbins having strands wound thereon and rotatably mounted on said frame, (a plurality of levers pivotally mounted on said frame so that for each bobbin there is a coacting lever,) an endless belt operatively mounted on said support frame and adapted to drivingly engage said plurality of bobbins, a plurality of levers pivotally mounted on said frame so that for each bobbin there is a coacting lever, means operatively connected to said endless belt for drivingly selectively connecting the latter to a bobbin including means for pressing said endless belt into engagement with the bobbin, and means for braking the rotary movement of each bobbin, both pressing and braking means being operatively mounted on each lever of said plurality of levers, tension sensitive means for detecting the tension of each of the strands being unwound from the bobbins and being operatively connected to respective ones of said plurality of levers to adjust the position of each lever with respect to the coacting bobbin in accordance with a predetermined strand tension at which said bobbin is to be paid out, whereby movement of the ever selectively engages the bobbin with the driving belt and braking means.

2. An arrangement according to claim 1, wherein said braking means, selectively cooperates with the bobbin so that the braking means is applied to the bobbin when the endless belt is uncoupled therefrom and so that the braking means is removed from the bobbin when the endless belt is applied thereto, and means connecting the tension sensitive means to the lever so that the braking means is applied to the bobbin when the tension of the strand being unwound is less than a predetermined desired value.

3. An arrangement according to claim 2, wherein the tension sensitive means is connected so that the lever turns in one direction to couple the bobbin to the endless belt and in the other direction to apply the braking means to the bobbin.

4. An arrangement according to claim 3, wherein the pivotal axis of the control lever is adjacent a first end of the lever, the pressing means and the braking means are mounted on different parts of the lever eccentric of but near said pivotal axis, and the other, second end of the lever is connected to the tension sensitive means.

5. An arrangement according to claim 1, wherein the (driving means comprises) bobbin includes a pulley affixed thereto

(to the bobbin), and wherein the pressing means comprises a roller which is variably thrust against the belt to press the latter with slipping engagement against the pulley, the force with which the roller presses against the belt being a function of the tension of the strand.

6. An arrangement according to claim 1, including a coupling operating member connected to each lever and (the means connecting) the respective tension sensitive means, (to the levers which comprises) said last named means comprising a cable connected at one zone to the tension sensitive means and at another zone to said support frame, a tension spring interposed in series in the cable between the support frame and the cable, and a second spring connected to the cable, at another location and to the coupling operating member, said second spring transforming the longitudinal displacement of the cable into a displacement of the coupling operating member.

7. An arrangement according to claim 6, comprising a stabilizer means mounted on the coupling operating member for variably frictionally connecting the cable to the coupling operating member while at least partially bypassing the connection provided by the second spring, said stabilizer means detecting variations in the speed of movement of the coupling operating member and selectively driving and braking the movement of the coupling operating member in accordance with the direction of such variation in such manner as to decrease the accelerations of the coupling operating member.

8. An arrangement according to claim 7, wherein the coupling operating member forms part of the pivotally mounted control lever upon which said means for pressing the belt is mounted, the tension sensitive means being connected to one end of the lever, the stabilizer means comprising a brake shoe pivotally mounted on said one end of the lever, and an eccentrically mounted weight urging the brake shoe into frictional engagement with the cable.

9. An arrangement according to claim 1, wherein the tension sensitive means comprises an oscillating arm mounted for pivoting about its center, the arm carrying a rotatably mounted, strand-engaging roller at each end, the rollers forming a loop of variable length in the strand, means yieldably rotating the arm in the loop-lengthening direction the means connecting the tension sensitive means to the plurality of levers comprising a reciprocable member attached to the oscillating arm eccentric of the axis thereof.

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