

[54] **STRAND PROCESSING APPARATUS**

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[58] Field of Search..... **72/3, 10, 11, 12, 274, 289, 72/292; 242/78, 147, 148 R, 153, 154**

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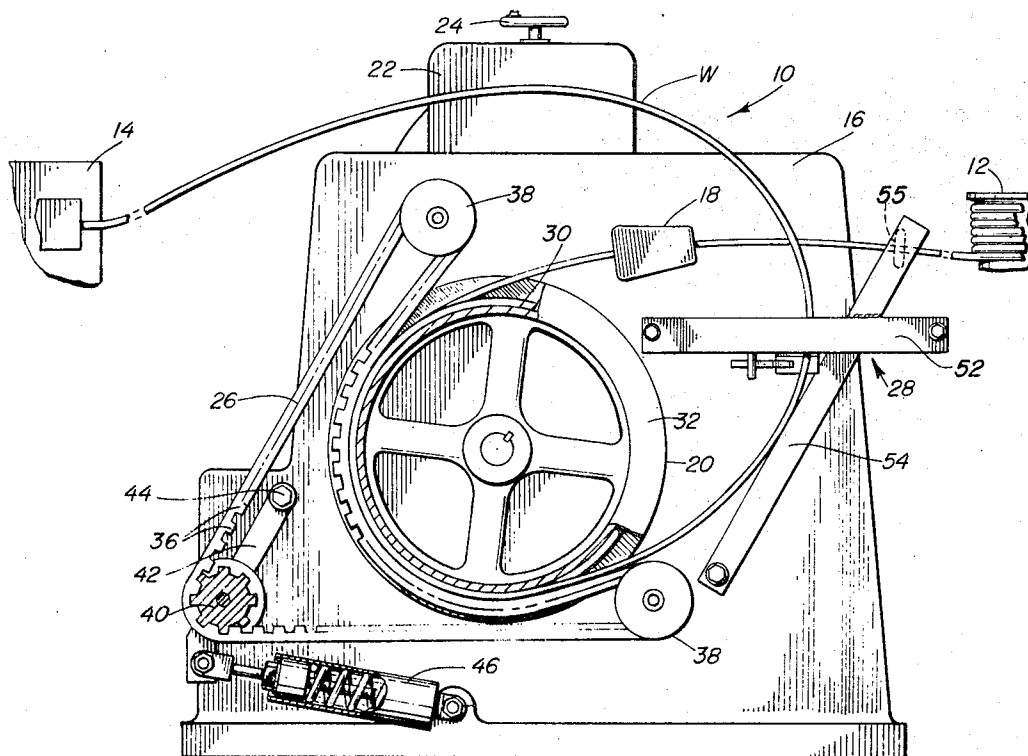
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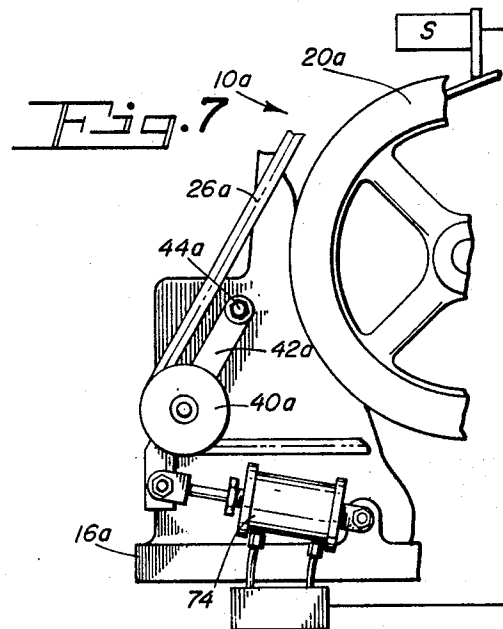
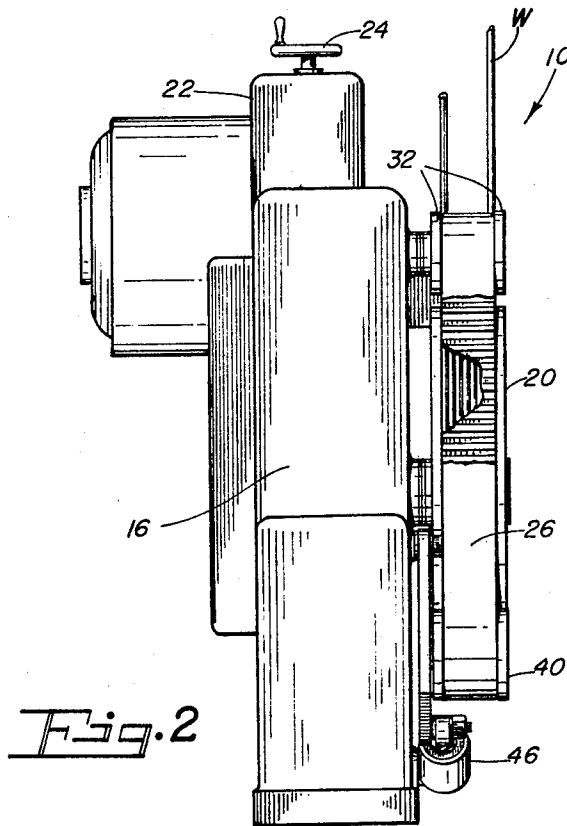
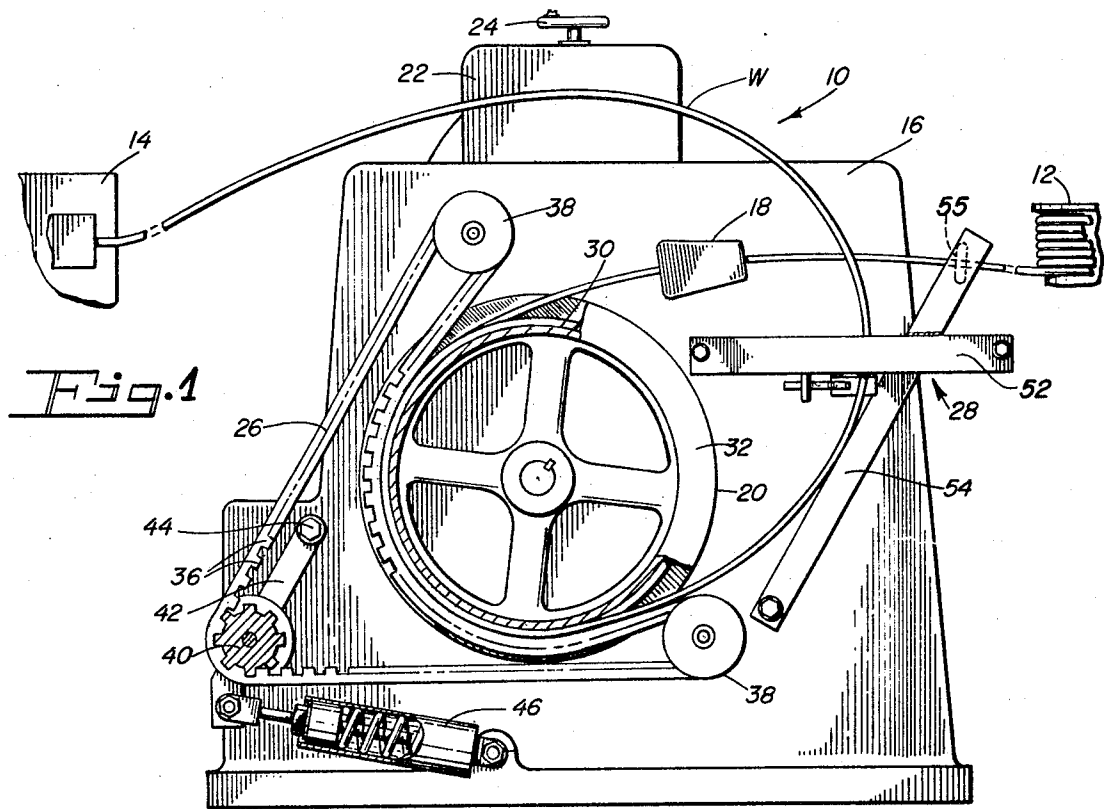
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[57] **ABSTRACT**

A wire drawing machine for continuously drawing a strand of wire received from a pay-off apparatus and advancing it along a generally predetermined path toward a take-up apparatus. The machine includes a draw box, a capstan for drawing the strand through the draw box, a drive unit for rotating the capstan, and a compensating mechanism including an endless cogged belt supported on cogged sheaves to run in positive timed relation therewith and in contact with a continuous arcuate portion of the strand on the capstan to maintain the strand in driving engagement with the capstan. The compensating mechanism also includes a control device responsive to deviation of the strand from its predetermined path for controlling the drive unit to maintain the machine in timed operative relation with the take-up apparatus.

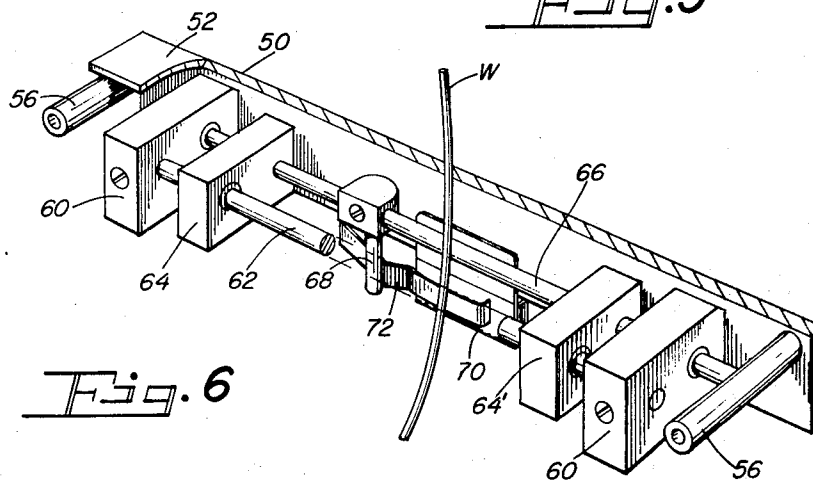
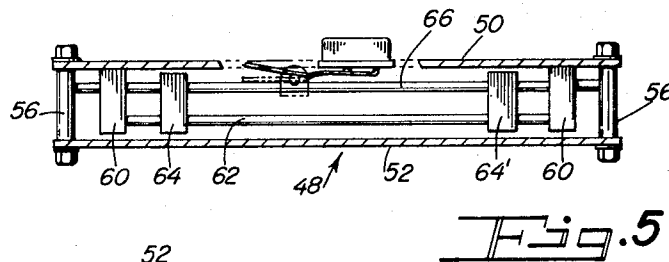
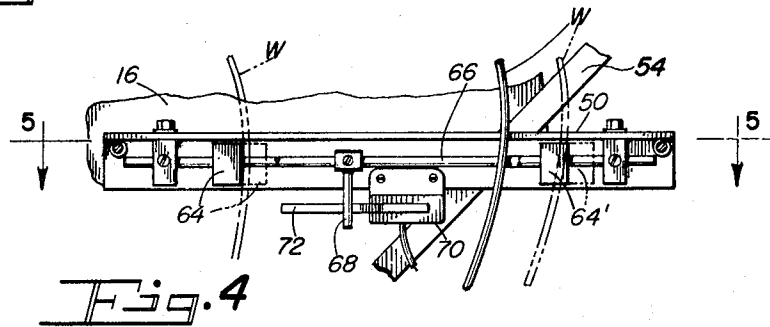
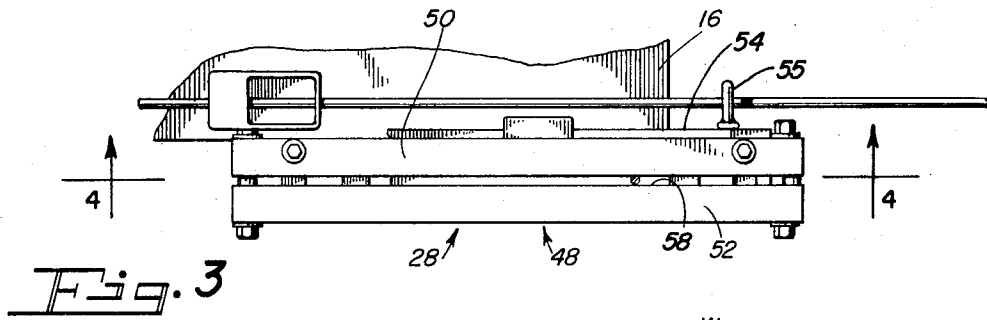
13 Claims, 7 Drawing Figures





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STRAND PROCESSING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to apparatus for processing a strand of material and deals more particularly with improved apparatus of the aforescribed type particularly adapted to continuously process a strand and feed it to a production machine which intermittently receives it. More specifically, the invention relates to an improved wire drawing or resizing machine for continuously processing a strand and feeding it to another machine which intermittently receives it, such as a cold header, four-slide machine or the like.

In a machine of the aforescribed type it is desirable that the strand to be processed pass continuously through a processing station at a substantially uniform rate to insure uniform processing. When a capstan is employed to advance the strand, any slippage of the strand with respect to the capstan will result in an interruption of the uniform strand flow through the processing station. Strand slippage may be avoided by maintaining adequate uniform tension on the strand as it leaves the capstan. However, it is not always possible to arrange a wire drawing machine so that constant uniform tension is maintained on the strand as it leaves the machine. This is particularly true when the wire drawing machine is arranged to feed wire to another machine which intermittently receives it, such as a cold header or four-slide machine. This problem is usually overcome by providing a compensating mechanism which maintains the strand in driving engagement with the capstan. Accordingly, it is the general aim of the present invention to provide a processing machine of the aforescribed type which includes an improved compensating mechanism to insure continuous uniform flow of material through the machine regardless of the feed requirements of a take-up apparatus associated therewith.

SUMMARY OF THE INVENTION

In accordance with the present invention, an improved strand processing apparatus is provided which includes a capstan for advancing a strand and a compensating mechanism which comprises a belt supported by a plurality of sheaves to run in constant contact with a continuous arcuate portion of the strand on the peripheral surface of the capstan to maintain the strand in driving engagement therewith. The belt has cogs thereon engaging cogs on the sheaves so that it travels in positive driving relation with the sheaves to minimize slippage in the mechanism. The compensating mechanism also includes an improved control device responsive to material flow through the processing machine to maintain timed relationship between the machine and a take-up apparatus associated therewith. The control device is constructed and arranged so that when the processing machine is operating normally or in timed relation with the take-up apparatus, it is wholly free of the influence of the control device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a wire drawing machine embodying the present invention and fragmentary portions of associated pay-off and take-up apparatus.

FIG. 2 is a left end elevational view of the machine of FIG. 1, portions of the belt mechanism thereof shown broken away.

FIG. 3 is a somewhat enlarged fragmentary plan view of the machine of FIG. 1 and shows the control device thereof.

FIG. 4 is a fragmentary sectional view taken along the line 4—4 of FIG. 3.

FIG. 5 is a fragmentary sectional view taken along the line 5—5 of FIG. 4.

FIG. 6 is a somewhat further enlarged fragmentary perspective view of the control device.

FIG. 7 is a fragmentary side elevational view of another machine embodying the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to the drawings and referring particularly to FIGS. 1 and 2, a wire drawing machine embodying the present invention and indicated generally at 10 is particularly adapted to process or re-size a strand of resilient wire W of indefinite length. The strand W is received from a pay-off apparatus or turntable 12 and advanced by the machine 10 along a generally predetermined path toward a take-up apparatus indicated at 14 which may, for example, comprise a production machine, such as a cold header or four-slide machine. The machine 10 has a frame 16 and includes a draw box 18 which supports a conventional drawing die and contains a quantity of drawing lubricant. A capstan 20 journaled for rotation relative to the frame 16 and driven by a variable speed drive unit 22 draws the strand W through the draw box 18 and advances it toward the take-up apparatus 14. A handwheel 24 associated with the drive unit 22 facilitates adjustment of the machine to operate at substantially the same speed as the take-up apparatus. In accordance with the present invention, a compensating mechanism comprising an endless flexible belt 26 is provided to maintain the strand W in driving engagement with the capstan 20, as will be hereinafter further discussed. The machine 10 also includes a control device indicated generally at 28 for energizing and de-energizing the drive unit 22, as required, to maintain timed relationship between the machine 10 and the take-up apparatus 14.

The capstan 20 has a generally cylindrical peripheral surface 30 bounded by a pair of annular flanges 32, 32. The width of the peripheral surface 30 is substantially greater than the maximum diameter of the largest wire to be drawn so that several turns of wire may be wrapped around the capstan in contact with the peripheral surface to insure maximum gripping traction under all operating conditions. The belt 26 has a plurality of cogs 36, 36 on the inner surface thereof for driving engagement with cogged sheaves 38, 38 and 40. The sheaves 38, 38 are circumaxially spaced with respect to the capstan 20 and are journaled in fixed position on the frame 16. The latter two sheaves are preferably spaced radially outwardly from the peripheral surface 30. The sheave 40 is carried by a link 42 which pivots on a stud 44 fastened to the frame 16. A tensioning device 46 acts between the frame 16 and the outer end of the link 42 to bias the sheave 40 away from the capstan and thereby maintain the belt 26

under tension. The belt is so arranged that a continuous arcuate portion of the outer surface thereof is in contact with an associated portion of the strand W on the peripheral surface 30. In the illustrated case the belt 26 contacts an associated portion of the strand over an arc of the peripheral surface 30 equal to approximately 100°. The belt mechanism assists in setup of the machine and prevents crossed or tangled wires on the capstan during setup. The radially outwardly spaced arrangement of the sheaves 38, 38 relative to the peripheral surface 30 permits a conventional gripper chain (not shown) to be used in threading or setting up the machine. The clogged arrangement of the belt and its associated sheaves effectively eliminates slippage in the compensating mechanism. A high degree of strand control is thereby achieved, and it has been found that a machine constructed in accordance with the present invention may be effectively employed to uniformly draw even relatively high tensile materials.

Considering now the control device 28 in further detail and referring particularly to FIGS. 3-6, the control device 28 generally comprises a bracket secured to the frame 16 and formed by two angle members 50 and 52 and a brace 54 which carries an eyebolt 55 for guiding the strand W. The members 50 and 52 are maintained in spaced relation by a pair of spacers 56, 56 and define an elongated guideway or horizontal slot 58 therebetween. The width of the slot is slightly greater than the diameter of the strand W after it has been drawn or re-sized. However, the width of the guideway may be adjusted to accommodate wire of other size by removing the spacers 56, 56 and replacing them with others of appropriate length. A pair of horizontally spaced apart support blocks 60, 60 are fastened to the angle member 50 below the slot 58. A rod 62 is fastened to the latter blocks and extends therebetween. A pair of sensing elements or slide blocks 64, 64' are supported for sliding movement in one and an opposite direction on the rod 62. Another rod 66 connects the slide blocks 64, 64 together for movement in unison. Each end of the rod 66 is respectively slidably received in an associated support block 60. The movable rod 66 carries a switch actuator 68 arranged for adjustable positioning therealong. The slide blocks 64, 64', the rod 66 and the actuator 68 comprise a block or slide assembly slidably movable on the rod 62 between a full line position and a broken line position shown in FIG. 4. The slide assembly is arranged to operate a switch 70 which is mounted on the member 50 and has a movable part or operating member 72 in the path of the actuator 68. The switch 70 is electrically connected to drive unit 22 and serves to energize or de-energize the drive unit to start or stop the machine 10 in response to movement of the slide assembly in one or the opposite direction, respectively. When the slide assembly is in its full line position as shown in FIG. 4, the actuator 68 engages an offset portion of the movable switch part 72 to hold the switch in a closed circuit condition, thereby energizing the drive unit 22 to effect operation of the machine 10. Movement of the slide assembly toward the right to its broken line position opens the circuit through the switch 70 to de-energize the drive 22 and stop the machine.

Referring now to FIG. 1, if the take-up apparatus 14 is started before the machine 10 is started, the strand W

will be drawn toward the left by the apparatus 14 from the generally predetermined path shown. A portion of the strand W will ultimately engage the slide block 64 at the left of the slide assembly causing the slide assembly to shift toward the left or to its full line position in FIG. 4. As previously noted, when the slide assembly is in the latter position, the drive unit 22 is energized to operate the machine 10. After the machine 10 has started, slight adjustment of the handwheel 24 may be required to adjust the strand W to advance or track along the generally predetermined path shown in FIG. 1 in timed relation with the apparatus 14. When the strand W is advancing along its generally desired path, it passes through the control device 28 between the slide blocks 64, and 64' and in spaced relation thereto, so that the control device exerts no influence thereon.

When the machine 10 is adjusted to operate at the speed of the take-up apparatus 14, the processed strand W is continuously advanced by the capstan 20 and toward the take-up apparatus 14 along its generally predetermined path. Some slight deviation from this path will occur due to intermittent advancement of the strand by the take-up apparatus 14. However, under normal operating conditions, this deviation is relatively slight and the strand continuously advances through the control device 28 free of the influence thereof. If a malfunction occurs which causes the take-up apparatus 14 to cease to advance the strand, it will be apparent that the strand will deviate from its predetermined path and move to the right relative to the control device 28, as it appears in FIG. 1. When the strand W engages the slide block 64' at the right of the slide assembly, the latter assembly will shift to the right or to its broken line position of FIG. 4 thereby opening the circuit through the switch 70 to stop the machine 10. After the defective condition has been corrected, the machine 10 may be re-cycled by shifting the slide assembly toward the left and adjusting the handwheel 24, as necessary, to re-establish the desired path of advance of the strand W.

Referring now to FIG. 7, another machine embodying the present invention is indicated generally at 10a. The machine 10a is similar in most respects to the machine 10, previously described, and parts substantially identical to parts previously described bear the same reference numerals as the previously described parts and a letter a suffix. The machine 10a differs from the machine 10 in the arrangement of its compensating mechanism. More specifically, the machine 10a includes an automatic device for tensioning the belt 26a. In the machine 10a a fluid motor or hydraulic cylinder 74 acts between the arm 42a and the frame 16a to bias the movable sheave 40a outwardly or away from the capstan 20a to increase tension in the belt 26a. The machine 10a also includes a sensing device indicated at S for detecting a change in the linear speed of the advancing strand W. Such a change in speed is indicative of slippage of the strand with respect to the capstan. The sensing device is interconnected with the hydraulic cylinder 74 and controls the operation of the cylinder to increase or decrease belt tension, as required, to assure continuous advancement of the strand W at a substantially uniform rate through the machine 10.

I claim:

1. In combination with a machine for continuously receiving and processing successive portions of a strand of material and including a strand processing station, a capstan for drawing the strand through said processing station and advancing it along a generally predetermined path to a strand take-up apparatus, and drive means for rotating said capstan, a compensating mechanism comprising a plurality of cogged sheaves supported on the machine and circumaxially and radially outwardly spaced relative to the peripheral surface of said capstan, an endless belt received on said sheaves and having cogs on the inner surface thereof for positive driving engagement with the cogs on said sheaves, said belt having a continuous arcuate portion of its outer surface in contact with an associated portion of the strand on said peripheral surface to hold the strand in driving engagement with said capstan, and control means responsive to deviation of the strand in one and the opposite direction from said generally predetermined path for controlling said drive means to control the advance of the strand.

2. The combination defined in claim 1 wherein said outer surface is in contact with an associated portion of the strand over an arc of the peripheral surface of said capstan equal to at least 100°.

3. The combination defined in claim 1 including means for varying the tension of said belt.

4. The combination defined in claim 3 including sensing means responsive to variation in the rate of advance of said strand for controlling said tension varying means.

5. The combination defined in claim 1 wherein said control means comprises means defining an elongated guideway positioned in said predetermined path and extending transversely thereof for receiving the strand therethrough, said guideway being adapted to restrain the strand for transverse movement relative thereto in one and an opposite direction from said predetermined path, first sensing means associated with said guideway for detecting movement of the strand relative to said guideway and from said predetermined path to one preselected limit of deviation in said one direction, and second sensing means associated with said guideway for detecting movement of the strand relative to said guideway and from said predetermined path to another preselected limit of deviation in said opposite direction.

6. In combination with a machine for continuously receiving and processing successive portions of a strand of material and including a strand processing station, a capstan for drawing the strand through the processing station and advancing it along a generally predetermined path to a strand take-up apparatus, and drive means for rotating said capstan, a compensating mechanism comprising means for maintaining an associated portion of the advancing strand in driving engagement with said capstan, and a control device including means defining an elongated guideway positioned in said predetermined path and extending transversely thereof for receiving an associated portion of the strand therethrough, said guideway being adapted to restrain the strand for transverse movement relative thereto in one and an opposite direction from said predetermined path, a first block supported for movement in one and said opposite direction relative to said guideway and movable in said one direction in response

to deviation of the strand in said one direction from said predetermined path and to one preselected limit to energize said drive means, and a second block supported for movement in said one and said opposite direction relative to said guideway and movable in said opposite direction in response to deviation of the strand in said opposite direction from said predetermined path and to another preselected limit to de-energize said drive means.

7. The combination defined in claim 6 wherein said first and second blocks are connected together for movement in unison and comprise a block assembly.

8. The combination defined in claim 7 wherein said control device includes an electrical switch electrically connected to said drive means and having an operating member in the path of said block assembly, said switch comprising means for energizing and de-energizing said drive means in response to movement of said block assembly in said one and said opposite direction respectively.

9. In combination with a machine for continuously receiving and processing successive portions of a strand of material and including a strand processing station, a capstan for drawing the strand through the processing station and advancing it along a generally predetermined path to a strand take-up apparatus, and drive means for rotating said capstan, a compensating mechanism comprising means for maintaining an associated portion of the advancing strand in driving engagement with said capstan, and a control device including a first sensing element supported by support means for movement in one and an opposite direction and movable in said one direction in response to deviation of the strand in said one direction from said predetermined path and to one preselected limit to energize said drive means, and a second sensing element supported by the same support means for movement in said one and said opposite direction and movable in said opposite direction in response to deviation of the strand in said opposite direction from said predetermined path and to another preselected limit to de-energize said drive means.

10. A combination as set forth in claim 9 wherein said control device includes means defining an elongated guideway positioned in said predetermined path and extending transversely thereof for receiving an associated portion of the strand therethrough, said guideway being adapted to restrain the strand for transverse movement relative thereto in said one and said opposite direction from said predetermined path, said first and second sensing elements supported for movement in one and said opposite direction relative to said guideway.

11. The combination as set forth in claim 10 including means connecting said first and second sensing elements for movement in unison.

12. The combination defined in claim 11 including an actuator carried by said connecting means and arranged for adjustable positioning thereon and relative to said sensing elements, and an electrical switch mounted in fixed position relative to said guideway and having an operating member in the path of said actuator, said switch comprising means for energizing and de-energizing said drive means in response to movement of said sensing elements.

13. In combination with a machine for continuously receiving and processing successive portions of a strand of material and including a strand processing station, a capstan for drawing the strand through said processing station and advancing it along a generally predetermined path to a strand take-up apparatus, and drive means for rotating said capstan, a compensating mechanism comprising a plurality of sheaves supported on the machine and circumaxially and radially outwardly spaced relative to the peripheral surface of said capstan, an endless belt received on said sheaves said belt having a continuous arcuate portion of its outer

surface in contact with an associated portion of the strand on said peripheral surface to hold the strand in driving engagement with said capstan, means for varying the tension of said belt, sensing means responsive to variation in the rate of advance of the strand for controlling said tension varying means, and control means responsive to deviation of the strand in one and the opposite direction from said generally predetermined path for controlling said drive means to control the advance of the strand.

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