July 27, 1965 O. HAUGWITZ 3,196,601

DEFLECTOR DEVICE FOR A REVOLVING WIRE OR THE LIKE

Filed Sept. 17, 1963 2 Sheets-Sheet 1

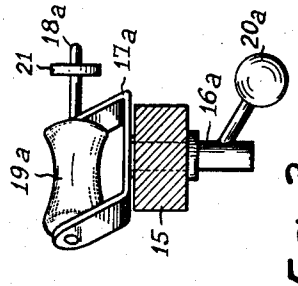

Fig. 3

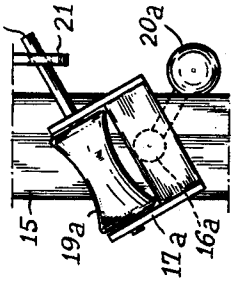

Fig. 4

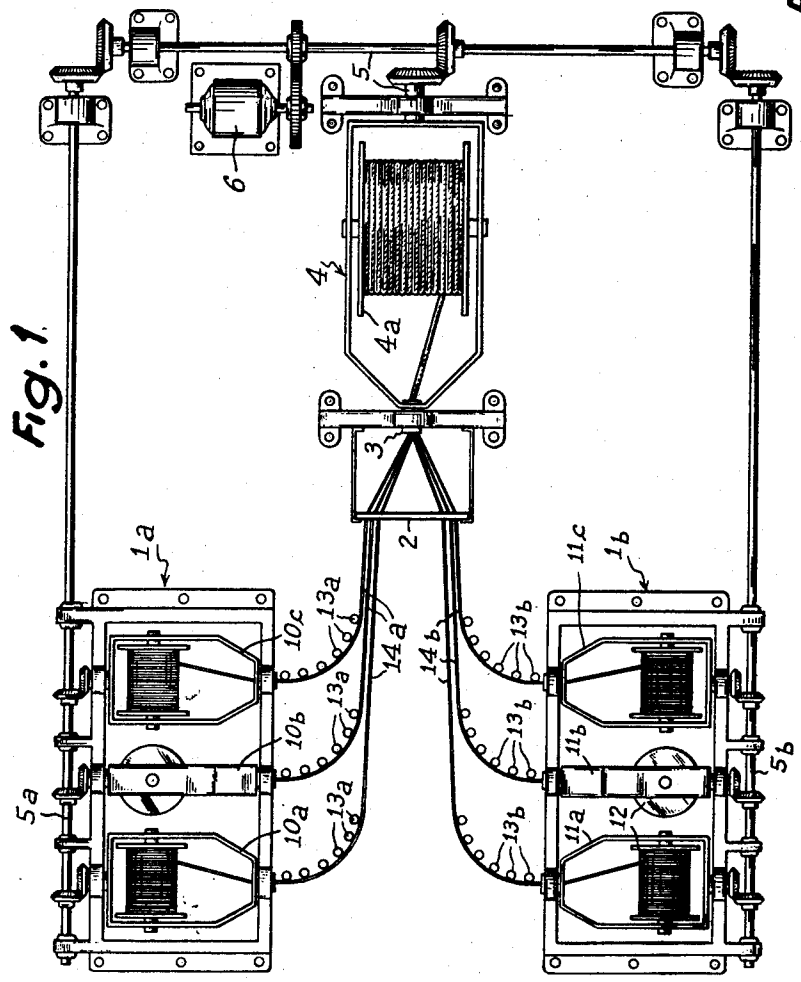

Fig. 1

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Fig. 2

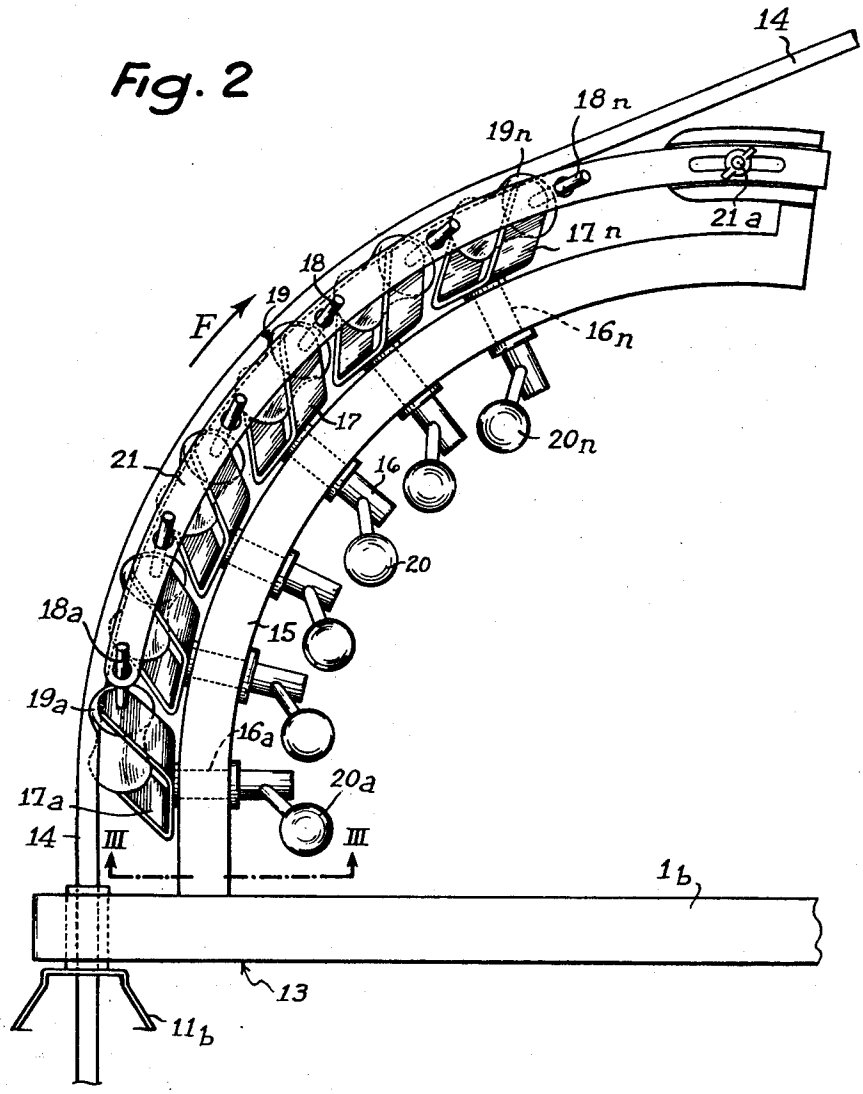
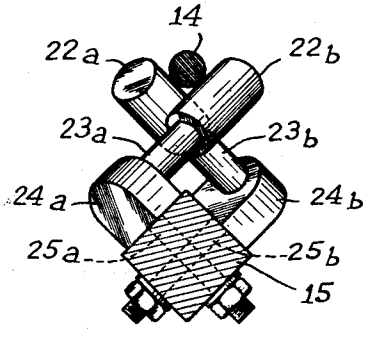


Fig. 5



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3,196,601

DEFLECTOR DEVICE FOR A REVOLVING WIRE OR THE LIKE

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11 Claims. (Cl. 57—60)

This invention relates to an improved device for deflecting the path of a wire, or similar continuously elongated flexible element, that is simultaneously driven in rotational and longitudinal displacement.

In cable and rope making plants, it is often required to alter the direction of longitudinal displacement of a wire or fibre which is being rotated about its own axis at the same time it is being longitudinally displaced. For example, consider a cable twisting machine including a plurality of draw-off units or drums and a common take-up unit or drum around which individual wires or strands from all the draw-off units are to be taken up in helically-assembled relation as a single rope or cable. In such a machine, both the draw-off drums and the take-up drum, in addition to revolving around their respective axes for transferring the wires from the former to the latter, must also be rotated in synchronism about respective axes normal to their axes of revolution in order to impart the requisite helical twist to the assembled rope without twisting the several elements themselves. It is usual in such a machine, for convenience in lay-out and economy of space, to dispose the draw-off units with their axes at an angle, e.g. normal to the axis of the common take-up unit. But this in turn requires that the path of each wire should be deflected by a corresponding angle between its outlet from the related draw-off unit and its input to the take-up unit. There are various other instances in which a similar deflection of the path of a wire or fibre being both fed axially and rotated about its axis is needed.

Heretofore, such deflection was generally effected by means of a pulley provided with a series of paired rollers around its periphery, so as to allow the wire to perform both its axial feed displacement and its rotation in a relatively frictionless and torsion-free manner. However, such conventional deflector devices have not been altogether satisfactory. The heavy pulley introduced objectionable inertia. It is cumbersome, space-consuming and expensive especially in view of the comparatively small arcuate extent of the pulley that is effectively utilized in many cases where the wire is to be deflected by only a small angle.

Objects of this invention are to provide an improved deflector device of the specified kind, which will be small in size, inexpensive to make and maintain, largely fixed so as to introduce substantially no inertia, and will perform its desired guiding and deflecting function in an extremely effective manner without imparting torsion to the element passing through it.

Essentially, the improved deflector may comprise a fixed arcuate supporting member corresponding in arcuate extent to the angle by which the path of the wire (or the like) is to be deflected, a series of roller supports mounted along the length of the arcuate member for pivotal movement with respect thereto about respective axes positioned generally on radial planes of the arcuate member, and rollers mounted on the roller supports for free rotation about axes generally normal to said first axes and engageable by said wire. Preferably, means are provided for constraining all the roller supports to pivot by similar angles about their respective radial axes.

The objects, features and advantages of the invention

will be made clear from the ensuing description of an exemplary embodiment selected by way of illustration but not of limitation and with reference to the accompanying drawings, wherein:

FIGURE 1 is a simplified overhead plan view of a cable twisting installation in which a plurality of the improved deflector devices of the invention are included;

FIGURE 2 is a larger-scale view of one of the improved deflectors;

FIGURE 3 is a section on line III—III of FIGURE 2, showing one of the roller supports with the roller thereon;

FIGURE 4 is an overhead view of FIGURE 3 as projected along the pivotal axis of the roller support; and

FIGURE 5 shows a modified form of roller support and roller means usable with the device of FIGURE 2, as it would be seen in section on a radial plane of the deflector device.

Referring to FIGURE 1, there is illustrated a generally conventional cable twisting plant as one example of the context in which the invention is of use. The plant comprises two draw-off frames **1***a*, **1***b* and a common take-up frame **4**. Each draw-off frame has means for drawing off three individual wires (or fibres, or strands) therefrom, as shown at **14***a* and **14***b*, and the six wires are led simultaneously through a distributor grid **2** and an assembly die **3** to the common take-up unit **4** to be coiled thereon in helically assembled relation as a single rope or cable.

Each of the draw-off frames **1***a*, **1***b* is accordingly provided with the three drums **12** mounted for rotation about their own axes in related cradles or frames **11***a*, **11***b*, **11***c*, the latter in turn being rotatable about parallel spaced axes, orthogonal to the axes of rotation of the drums, in the related draw-off frame such as **1***b*. The take-up frame **4** comprises a large drum **4***a* mounted for rotation about its own axis in the frame **4**, which latter in turn is rotatable about an axis orthogonal to the axis of rotation of the drum **4***a*. Means are provided for imparting synchronous rotation to both the revolving draw-off frames, such as **11***a*, **11***b* and **11***c*, and the take-up frame **4**, and comprises a motor **6** which through suitable shafting and gearing **5** rotates the frame **4** and, through shafts **5***a*, **5***b*, synchronously rotates the respective revolving draw-off frames, such as **11***a*, **11***b* and **11***c*. Further, the take-up drum **4***a* is rotated about its own axis in frame **4**, through means not shown, for imparting the suitable draft force to the individual wires **14***a*, **14***b* and coiling them up around the periphery of drum **4***a*.

The system thus described is generally conventional so that the brief description just given should suffice. It will be noted that, in the lay-out shown, the individual wires **14***a*, **14***b* issue out of the draw-off frames **1***a*, **1***b* axially of the revolving frames such as **11***a*, **11***b*, **11***c*, and that the draw-off units are so arranged with respect to the take-up unit **4** that the wires **14***a*, **14***b* must be deflected about 90° between their points of egress from the draw-off frames and their point of entry into the distributor grid **2** ahead of the take-up frame. This permits a more convenient lay-out of the draw-off frames, particularly when these are relatively many in number, and reduces the requisite floor space. To achieve the necessary deflection in the path of feed of the wires **14***a*, **14***b*, there is associated with each wire an improved deflector device according to the invention, these devices being schematically shown in FIGURE 1 and there designated **13***a*, **13***b*. The construction of one such device will now be described with reference to the detailed showing in FIGURE 2.

The deflector device **13** comprises a fixed supporting member **15** in the general form of an arc of a circle, herein about 90° in angular extent. Any suitable means are provided for fixedly securing support **15** to the re-

lated fixed draw-off frame structure such as 1*b*. The member 15 is formed with a plurality of spaced bores therethrough, extending radially of the arcuate member 15, i.e. having their geometrical axes all converging to the common center of curvature of said member. Pivot shafts 16*a* through 16*n* are mounted for free rotation in the respective bores, and the shafts carry at their outer projecting ends related clevis or stirrup members 17*a* through 17*n*. Antifriction means may if desired be associated with shafts 16*a*–16*n* but have not been shown herein.

Across the parallel spaced legs of each clevis 17 is freely pivoted a pin 18 with a roller 19 supported between the legs of the clevis. The rollers are preferably in the form of spools with concave profiles as shown. Alternatively they may be grooved or flanged. As will also be apparent from the drawings, the legs of each clevis are slanted so that the pivot 18 of each roller 19 is offset from the axis of the related pivot shaft 16, in the same general direction as that of the axial displacement of the wire 14 through the device, indicated by arrow F. In order to compensate for the unbalanced weight thus produced around the axis of the pivot 16 of each clevis and roller unit, a counterweight 20 is preferably provided projecting from the inner end of shaft 16 in a direction generally opposite from that in which the legs of the clevis slant.

Means are provided for constraining all of the roller units to assume equal angular positions about the pivot shafts 16, and such means may comprise an arcuate segment 21 formed with spaced holes through which the ends of the pins 18*a* through 18*n* can freely project. The segment 21 can be locked in an adjusted position with respect to the arcuate support 15 by a wing nut 21*a* engaging a threaded hole in the side of member 15 and cooperating with an elongated slot in segment 21.

In operation, it will be understood that when the take-up drum 4 is rotated to exert a draft force on each element 14 as earlier described, such draft force will be manifest as a radial inward pressure exerted by the wire element 14 against the rollers 19*a* through 19*n*. The rollers are driven in rotation about the pins 18*a* through 18*n*. Moreover, the rotation of the element 14 about its axis applies a frictional force to the rollers, and this force owing to the offset present between its point of application and the axis of each radial pivot 16, due to the inclined legs of the clevis 17, creates a moment of rotation about the pivot 16. It can be shown that in respect to each of the end rollers 19*a* and 19*n* of the series, this moment results in rotating the related clevis supports 17*a* and 17*n* by an angle α, as measured between the axis of rotation of the roller 19 and the direction of feed of element 14, such that

$$\text{cotan } \alpha = \frac{\text{diameter of element 14}}{\text{pitch length of cable}}$$

said pitch length being the ratio of the linear velocity of the wire to the angular velocity of its rotation. Owing to the provision of the coupling segment 21, all the rollers of the series are constrained to rotate about their pivots by a similar angle and, in this rotated condition of all the roller supports about their radial pivots, with the wire or rope element 14 engaging the rollers at points displaced sideways from the axial midpoint thereof, it is found that said element 14 is entirely free from any torsion or twist as it moves over the deflector device.

In most cases, it is desirable to leave the locking nut 21*a* in its loose condition, and allow the coupling segment 21 to seek out its own position of equilibrium, in which all the roller supports 17 are simultaneously rotated about their pivots by angles determined by the feed velocity and rotational velocity of the wire element 14, as just described. However, especially with relatively large deflection angles imparted to the path of the wire, such automatic operation may not be entirely reliable and, in such cases, it is preferred to use nut 21*a* to lock the segment 21 in a position in which it causes all the roller supports 17 to assume a predetermined orientation angle α, computed in dependency on the desired feed and angular or rotational velocities (and the diameter of the element), in order thus to achieve in a more positive manner the desired twist-free condition of the element 14. It will be apparent that, in such cases where the angular rotation of the roller supports is deliberately fixed rather than being automatically induced by the rotational friction of the wire element, the above-mentioned displacement or offset between the axis of pivot 16 and the area of contact of the element with the roller 19, as provided by the inclined clevis legs, becomes unnecessary and the roller supports may then be made straight rather than slanting. Also, the counterweights 20 may then be omitted.

Various other modifications may be conceived within the scope of the invention. Thus, instead of using the concave single rollers 19 disclosed above, paired rollers can be used as shown in FIGURE 5. As shown, the two rollers 22*a*, 22*b* of each pair are cylindrical and are mounted on pins 23*a*, 23*b* projecting from supports 24*a*, 24*b* mounted on pivots 25*a*, 25*b* extending through the arcuate member 15 in generally radial planes thereof. The pivots 25*a*, 25*b* extend at right angles to each other being angularly displaced 45° to opposite sides from a central longitudinal plane of the member 15, and the same is true of the pins 23*a*, 23*b*, so that the rollers 22*a*, 22*b* define in projection on a transverse plane, as shown in FIGURE 5, a V for cradling the element 14 between them. It can readily be seen that the general operation of this modification is the same as in the first form, with the frictional forces developed by the rotation of element 14 creating couples which tend to rotate the supports 24*a*, 24*b* in corresponding directions, by angles depending on the winding pitch length or ratio of linear to angular velocity of the element (and diameter thereof), and that in the rotated positions the element 15 is substantially torsion-free.

What I claim is:

1. A device for deflecting the path of a continuous flexible element which is simultaneously fed longitudinally along said path and rotated about its longitudinal axis, which device comprises a stationary arcuate supporting member corresponding in arcuate extent to the angle by which said path is to be deflected, a series of roller supports spaced along the length of the arcuate member, and mounted on the arcuate member for pivotal movement about axes extending in generally radial planes of said member, and rollers mounted on said supports for free rotation about axes generally transverse to the first axes, said rollers being engageable by said flexible element.

2. In a system having means for feeding a continuous flexible element over a longitudinal path and simultaneously rotating the flexible element about its longitudinal axis, a device for deflecting the path of the element comprising a stationary arcuate supporting member; a series of roller supports spaced along the member and mounted for pivotal movement about axes extending in generally radial planes of the member; rollers mounted on said supports for free rotation about axes generally normal to said first axes and engageable by said flexible element, and means coupling said roller supports to constrain them to assume corresponding angular positions about said first axes.

3. The device claimed in claim 1, wherein said roller supports are arranged so that the point of engagement of each roller by said flexible element is offset from the pivotal axis of the roller support.

4. In a system having means for feeding a continuous flexible element over a longitudinal path and simultaneously rotating the flexible element about its longitudinal axis, a device for deflecting said path comprising a stationary arcuate member; a series of roller supports spaced

along the member and mounted on the arcuate member for pivotal movement about radial axes intersecting the member's centre of curvature; and rollers mounted on said supports for rotation about axes normal to said radial axes, and having generally concave profiles for cradling engagement with said flexible element.

5. The device claimed in claim 4, wherein said roller supports include clevis-like portions with spaced legs across which said rollers are mounted for rotation about said second-mentioned axes.

6. The device claimed in claim 5, wherein said legs are inclined so that the axis of roller rotation is offset from the pivotal axis of the support.

7. The device claimed in claim 1, wherein said rollers are provided in pairs, the rollers in each pair being mounted for rotation about respective axes symmetrically angularly displaced to opposite sides from the general plane of said supporting member so as to form a V in which said flexible element is cradled.

8. The device claimed in claim 7, wherein the supports of the respective rollers of each pair are pivoted to said supporting member about axes respectively normal to said roller axes and correspondingly angularly displaced from said general plane.

9. The device claimed in claim 2, wherein said coupling means comprises an arcuate coupling member formed with spaced means along its length for engagement with the respective roller supports.

10. The device claimed in claim 9, comprising means for locking said coupling member in a predetermined position relative to the supporting member.

11. The device claimed in claim 3, including counterweight means on said roller supports for balancing the weight of the offset rollers.

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MERVIN STEIN, *Primary Examiner.*