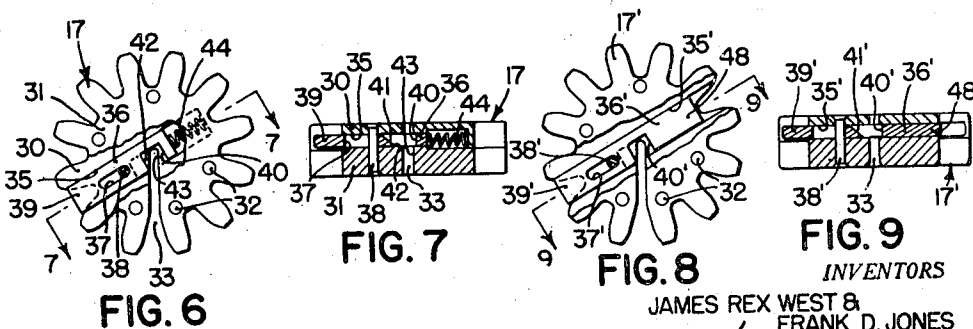
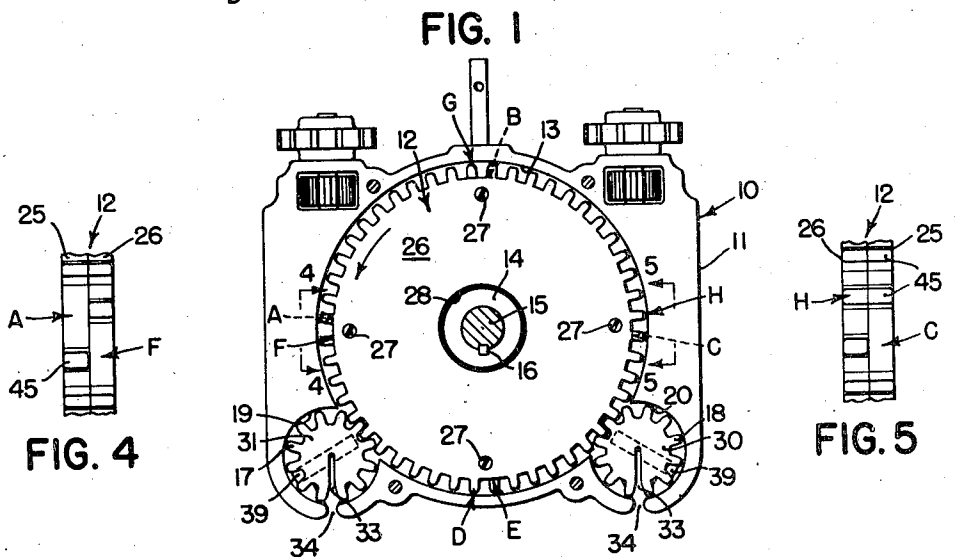
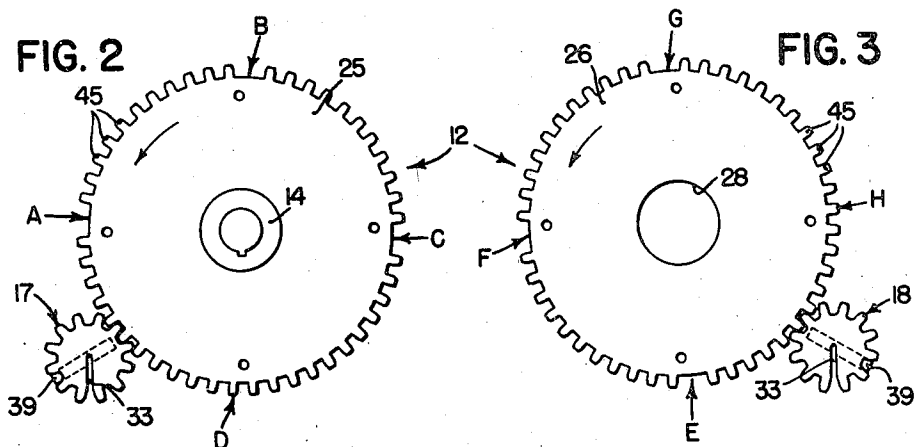


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WIRE TYING MECHANISM

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The present invention relates generally to wire tying mechanisms, with particular emphasis on wire tying mechanism used in automatic pick-up hay balers, and is in the nature of an improvement or modification in the wire tying mechanism shown and described in a co-pending application, Serial No. 594,684, filed May 19, 1945, by Miles H. Tuft.

The principal object of our invention relates to the provision of a novel and improved wire tying mechanism. A more specific object relates to the provision of a novel and improved means for severing the strands of wire after the latter have been twisted together to form a knot.

In the wire tying mechanism disclosed in the co-pending Tuft application, the two strands of wire to be tied are inserted into a radially extending slot in a twister gear, which is rotated several revolutions to twist the two strands of wire together, thereby forming two twisted portions extending on opposite sides of the twister gear. A pair of kinking members on opposite sides of the twister gear, respectively, then are actuated to bend or kink the twisted portions on opposite sides of the gear and one of the kinking members is provided with a cutting element which cooperates with the side face of the twister gear to sever the twisted strands as closely as possible to the center of the twisted portion. However, since the cutting element severs the strands at one edge of the slot in the twister gear, the portion of the strands lying within the slot remains attached to one of the twisted portions after the severing has been completed. It is desirable, however, to sever the strands in the exact center of the twisted portion in order that the kinking members may provide two spaced bends or kinks in each twisted portion in order to more completely condition both of the knots thus formed, against untwisting and pulling apart. Therefore, a further object of the present invention relates to mechanism which severs the twisted wire strands substantially along the central plane of revolution of the twister gear.

These and other objects and advantages of our invention will be apparent to those skilled in the art after a consideration of the following description, in which reference is had to the drawings appended hereto, in which

Figure 1 is an elevational view of the wire tying mechanism, in which one of the housing sections of the case has been removed to expose the twisting gears and the drive gear therefor;

Figure 2 is an elevational view of one half of

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the laminated drive gear and one of the twisting gears in mesh therewith;

Figure 3 is an elevational view of the other half of the laminated drive gear and the other twister gear in mesh therewith;

Figure 4 is a fragmentary view taken along a line 4—4 in Figure 1, showing a portion of the periphery of the drive gear, in which teeth have been omitted from both halves of the laminated drive gear to prevent the actuation of both of the cutting elements in the twister gears and drawn to an enlarged scale;

Figure 5 is a partial elevational view of the periphery of the drive gear, taken along a line 5—5 in Figure 1, and showing a tooth arrangement which provides for actuating the cutting element of one of the twister gears but not the other and drawn to an enlarged scale;

Figure 6 is an enlarged elevational view of one of the twister gears showing a portion broken away to expose the cutting element within the gear;

Figure 7 is a sectional view taken along a line 7—7 in Figure 6;

Figure 8 is an elevational view similar to Figure 6, but showing a modified form of the cutting element; and

Figure 9 is a sectional view taken along a line 9—9 in Figure 8.

Referring now to the drawings, the wire tying mechanism is housed within a casing 10 comprising two half sections, one of which is removed in Figure 1 to show the mechanism, the other half section being indicated by reference numeral 11. A drive gear 12 is rotatably disposed within a circular recess 13 in the casing section 11 and is provided with a hub 14 mounted on a drive shaft 15 and keyed thereto by a key 16. A pair of twister gears 17, 18 are disposed in meshing relation to the drive gear 12 and are spaced peripherally of the latter. The twister gears 17, 18 are rotatably disposed within a pair of circular recesses 19, 20, respectively, in the inner face of the casing 11 and are rotatably supported on the ends of the twister gear teeth, which slidably bear against the circular walls of the recesses 19, 20, thereby eliminating the necessity for supporting shafts.

The drive gear 12 comprises a rigid assembly of two gears 25, 26, which are placed together face to face and are rigidly secured together by means of bolts 27. One of the gears 25 is mounted on the hub 14, while the other gear 26 is provided with a central aperture 28 which receives the hub 14 of the gear 25. Thus, the

two gears 25, 26 are congruent, except for the omission of certain teeth in each of the gears, as will be explained later.

Each of the twister gears 17, 18 also comprises a pair of substantially congruent gear sections 30, 31, their flat sides being placed together and rigidly secured by a plurality of rivets 32 or other suitable means. Each of the gears 17, 18 is provided with a radially extending slot 33, which extends from the central axis of the twister gear outwardly therefrom between two of the gear teeth, and the slot 33 is normally opening downwardly in register with a slot 34 in the gear casing 11.

One of the gear laminations 30 is provided with a diametrically extending recess 35 on the inner face of the gear section 30, within which is slidably disposed a cutting element 36. Thus, the recess 35 is closed by the other gear section 31, so that the only opening of the recess 35 is in the periphery of the twister gear. The cutting element 36 is provided with a longitudinally extending slot 37, which receives a pin 38 extending through aligned apertures in the two gear sections 30, 31, for preventing the cutting element 36 from dropping out of the recess 35 but permitting longitudinal sliding movement therein. The outer end 39 of the cutting element 36 projects radially outwardly from the recess 35 between two of the teeth in the gear section 30, which is adapted to engage the end of a tooth of the drive gear 12 during rotation, for sliding the cutting element inwardly within the recess 35.

The recess 35 intersects the inner end of the slot 33 and the inner end of the cutting element 36 is provided with a notch 40, one edge 41 of the notch 40 being beveled to provide a cutting edge 42. The cutting edge 42 bears against the inner face of the gear section 31 and thus lies substantially on the central plane of revolution of the twister gear, and when the cutting element 36 is shifted inwardly in the recess 35, the cutting edge 42 cooperates with an edge 43 of the slot 33 in shearing relation, to sever the strands of wire within the slot 33 and substantially at the center of the gear 17. A small helical compression spring 44 is disposed in the end of the recess 35, the latter being enlarged slightly to receive the spring 44. The purpose of the spring 44 is to return the cutting element 36 to a normal inactive position, as shown in Figures 6 and 7, with the cutting edge 42 clear of the slot 33 and the outer end 39 projecting outwardly beyond the roots of the teeth of the gear section 30.

The driving gear 12 is several times the diameter of the twister gear 17, for example, four times, as shown in the illustrated embodiment, and therefore one revolution of the drive gear 12 causes the twister gear 17 to rotate four times. It is necessary, however, that the twisting of the wire strands together be completed before the strands are severed, requiring that the outer end 39 of the cutting element 36 shall be engaged by one of the teeth 45 of the drive gear 25 after the latter has made almost a complete revolution. Hence, the teeth 45 of the gear lamination 25 are omitted at peripherally spaced points A, B, and C, which are the three points at which the outer end 39 of the cutting element 36 is in proximity to the drive gear section 25. In other words, with the drive gear 25 rotating in a counter clockwise direction, as indicated by the arrows, the twister gear 17 rotates in a clockwise

direction and when the latter has rotated one half revolution, the end 39 of the cutting element 36 rotates into the space A, but since the tooth of the large gear section 25 has been omitted at this point, the cutting element 36 is not shifted to sever the wire strands in the slot 33. Another quarter of a revolution of the drive gear 25 rotates the twister gear 17 through a complete revolution, but when the end 39 of the cutting element 36 is at the position B, the cutting element 36 is again allowed to remain stationary within the recess 35, in view of the fact that at position B another tooth is omitted. Similarly, in position C, a third tooth 45 of the drive gear 25 is omitted, at which point the twister gear 17 has rotated through two and one half revolutions. Another quarter of a revolution of the drive gear 25 brings the outer end 39 of the cutting element into position D on the drive gear, but here the tooth 45 of the latter is not omitted and therefore engages the end 39 and pushes the cutting element into the recess 35, thereby severing the wire strands within the slot 33 after three and one half revolutions of the twister gear, after which the drive gear 25 completes its fourth revolution, thereby returning the twister gear 17 to the position shown in the drawing. As soon as the end 39 of the cutting element 36 disengages from the tooth 45 of the drive gear, the spring 44 returns the cutting element to its normal inactive position, as limited by the pin 38 in the slot 37.

The other twister gear 18 is provided for the purpose of tying a second bale tie, and is identical with the twister gear 17, but is placed in the recess 20 in inverted position with respect to the twister gear 17. Thus, whereas twister gear 17 is placed in the recess 19 with the recessed lamination 30 on the bottom, to mesh with the lower drive gear lamination 25, the twister gear 18 is placed with the recessed lamination 30 uppermost, to mesh with the upper drive gear lamination 26. Teeth are omitted from the gear section 26 in each of the positions E, F, and G, corresponding to one half, one and one half, and two and one half revolutions of the twister gear 18, and therefore the end 39 of the cutting element 36 of twister gear 18 is not actuated until it engages a tooth 45 at position H. It will be noted that the positions A, B, and C on the first gear lamination 25 are spaced peripherally from the positions E, F, and G on gear segment 26, therefore there is no position in which a complete tooth is missing from the entire face of the drive gear 12. Therefore, there is no position in which the twister gears do not mesh positively with teeth on the drive gear 12, for there is always at least one half of the tooth 45 in mesh with the teeth on the twister gears 17, 18.

Referring now to Figures 8 and 9, which show a modified cutting element 36', the diametrical recess 35' extends entirely across the twister gear 17'. The cutting element 36' is provided with an end portion 48, opposite the actuating end portion 39'. The length of the cutting element 36' is such that in the normal inactive position, shown in Figures 8 and 9, the end 48 of the element is disposed adjacent the roots of the teeth of the twister gear 17'. This cutting element 36' operates in substantially the same manner as that in the previous embodiment, to sever the wire strands when the end 39' engages one of the teeth 45 of the drive gear 12, but instead of having a spring 44 to return

the cutting element 36' to normal position, the cutting element remains in its cutting position for one half revolution, whereupon the end 48 of the cutting element 36' engages one of the teeth 45 of the drive gear 12, and is thus shifted positively back to the normal inactive position.

We claim:

1. In wire tying mechanism, a rotatable twister member having a slot therein for receiving two strands of wire to be twisted together by rotation of said member, a cutting element, and means mounting said element on said member providing for rotation of the element with the member and for shifting movement of said element relative to said member, said element having a shearing edge and said member having a cooperable shearing edge, and means engageable with said element during rotation of said member to shift said element to move said shearing edges together to sever said wire strands.

2. In wire tying mechanism, a rotatable twister gear having a radially extending slot therein for receiving strands of wire to be twisted together by rotation of said gear, a second rotatable gear disposed in meshing engagement with said twister gear, a cutting element shiftable mounted on said twister gear for severing said wire strands and rotatable with said twister gear, said element and said second gear having interengageable parts for shifting said element to sever said strands.

3. In wire tying mechanism, a rotatable twister gear having a radially extending slot therein for receiving strands of wire to be twisted together by rotation of said gear, a second rotatable gear disposed in meshing engagement with said twister gear, a cutting element shiftable mounted on said twister gear for severing said wire strands and rotatable with said twister gear, said element having a radially extending actuating portion projecting outwardly of the roots of the teeth on said twister gear and engageable with the teeth on said second gear during rotation of said gears, for actuating said cutting element.

4. In wire tying mechanism, a rotatable twister gear having a radially extending slot therein for receiving strands of wire to be twisted together by rotation of said gear, a second rotatable gear appreciably larger in diameter than said twister gear and disposed in meshing engagement with the latter, means for rotating said gears whereby said twister gear rotates through a plurality of revolutions to one revolution of said second gear, a cutting element mounted on said twister gear for radial shifting movement for severing said wire strands and rotatable with said twister gear, said element having a part extending radially outwardly, and means on said second gear positioned to engage said part during rotation of said gears for actuating said cutting element after said twister gear has been rotated through several revolutions to twist said strands.

5. In wire tying mechanism, a rotatable twister gear having a radially extending slot therein for receiving strands of wire to be twisted together by rotation of said gear, a second rotatable gear appreciably larger in diameter than said twister gear and disposed in meshing engagement with the latter, means for rotating said gears whereby said twister gear rotates through a plurality of revolutions to one revolution of said second gear, a cutting element mounted on said twister gear for radial shifting movement

for severing said wire strands and rotatable with said twister gear, said element having a part extending radially outwardly beyond the roots of the teeth of said twister gear to engage the teeth on said second gear during rotation, for actuating said cutting element, certain teeth of said second gear being omitted to prevent the actuation of said cutting element until said twister gear has been rotated through a plurality of revolutions.

6. In wire tying mechanism, a rotatable twister gear having a slot therein for receiving strands of wire to be twisted together and a radially extending recess, and a cutting element slidably disposed in said recess and having a cutting edge cooperable with an edge of said slot to sever the wire strands and an actuating portion projecting radially beyond the roots of the teeth, means engageable with said actuating portion during rotation of said gear to slide said element in said recess to sever said wire strands, and means for returning said element to a normal inactive position.

7. In wire tying mechanism, a rotatable twister gear having a slot therein for receiving strands of wire to be twisted together and a radially extending recess, and a cutting element slidably disposed in said recess and having a cutting edge cooperable with an edge of said slot to sever the wire strands and an actuating portion projecting radially beyond the roots of the teeth, means engageable with said actuating portion during rotation of said gear to slide said element in said recess to sever said wire strands, and a spring in said recess engaging said element for returning the latter to a normal inactive position.

8. In wire tying mechanism, a rotatable twister member having a radially extending slot therein for receiving strands of wire to be twisted together and a diametrically extending recess, a cutting element slidably disposed in said recess and having a cutting edge engageable with said wire strands for severing the latter, means engageable with one end of said cutting element during rotation of the member for shifting said element in one direction in said recess to sever said strands, and means engageable with the other end of said cutting element during rotation of said member for shifting said element in the other direction in said recess to return the element to a normal inactive position.

9. In wire tying mechanism, a rotatable twister gear having a radially extending slot therein for receiving strands of wire to be twisted together and a diametrically extending recess, a cutting element slidably disposed in said recess and having a cutting edge engageable with said wire strands and cooperable with an edge of said slot for severing the strands, a second gear disposed in meshing relation with said twister gear, said cutting element having one end extending beyond the roots of the teeth of said twister gear and engageable with the teeth of said second gear during rotation, thereby sliding said element into cutting position, the opposite end of said element being moved outwardly beyond the roots of the gear teeth on the opposite side of the twister gear and engageable with the teeth of said second gear during rotation to return said cutting element to a normal position.

10. The combination set forth in claim 9, including the further provision that said second gear is appreciably larger in diameter than said twister gear and transmits power to drive the latter, certain of the teeth of said second gear

being omitted to prevent actuation of said cutting element until said twister gear has rotated through a plurality of revolutions.

11. In wire tying mechanism, a rotatable drive gear of comparatively large diameter and a pair of twister gears of comparatively small diameter meshing with said drive gear at peripherally spaced points thereon, each of said twister gears having a radially extending slot therein for receiving strands of wire to be twisted together and a diametrically extending recess disposed on one side of the central plane of rotation, said gears being assembled with said recesses in said twister gears being disposed on relatively opposite sides of their central plane of rotation, a cutting element slidably disposed in each of said recesses having a cutting edge engageable with the wire strands in said slot for severing the latter, each element having one end projecting outwardly beyond the roots of the teeth of the associated twister gear and rotatable into engagement with a tooth on said drive gear to shift said element into cutting relation, said drive gear having a portion of the axial length of certain teeth omitted in register with said projecting ends of said cutting elements, to prevent the latter from being actuated until said twister gears have been rotated through a plurality of revolutions.

12. The combination set forth in claim 8, including the further provision that said recess extends inwardly of the body of said twister member from the periphery of the latter and enclosed by the sides thereof, and said cutting element has a cutting edge lying substantially on the central plane of rotation of said member.

13. The combination set forth in claim 8, including the further provision that said twister member comprises a gear having a pair of congruent laminations rigidly fixed together, one of which has the said diametrical recess in its inner surface to position the cutting element substantially on the central plane of revolution of said gear.

14. The combination set forth in claim 11, including the further provision that each of said twister gears comprises a pair of congruent laminations rigidly fixed together, one of which has

the said diametrical recess in its inner surface to position the cutting element substantially on the central plane of revolution of said gear and said drive gear comprises a pair of laminations rigidly fixed together, each of which has certain teeth omitted to prevent premature actuation of the associated cutting element.

15. In wire tying mechanism, a rotatable twister member having a slot therein for receiving strands of wire to be twisted together, a cutting element, means mounting the cutting element on the twister member for rotation therewith and also for shifting of the element on and generally radially with respect to the twister member toward and away from the wire-receiving slot, and means on said element for cooperation with one edge of said slot for severing the wire strands.

16. In wire tying mechanism, a rotatable twister member having means therein for receiving strands of wire to be twisted together, a cutting element, means contained wholly by the twister member and cooperable means contained wholly by the cutting element interengageable to mount the cutting element on the twister member for rotation therewith and for shifting of the cutting element bodily with respect to the twister member toward and away from the wire-receiving means, and means on the cutting element cooperable with the wire-receiving means for severing the wire strands.

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