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(71) Applicant

**Hesston Corporation (USA-Kansas),  
Box 788, Hesston, Kansas 67062, United States of  
America**

(72) Inventor

**Allen A White**

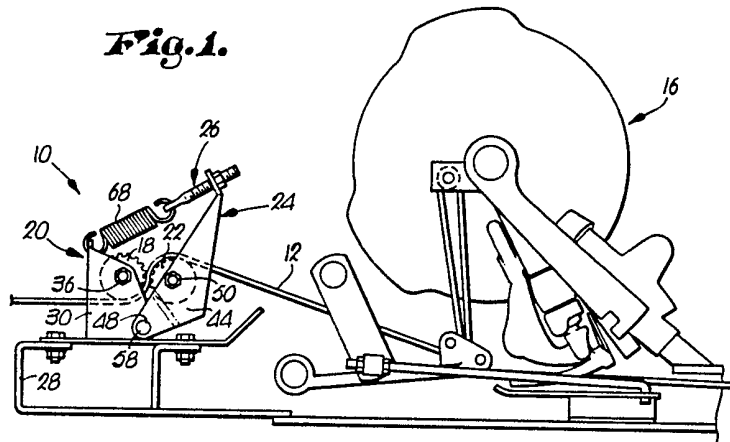
(74) Agent and/or Address for Service

**Fitzpatricks,  
4 West Regent St, Glasgow G2 1RS**

(54) **Twine tensioner for crop baler knotter**

(57) A twine tensioning device, specifically designed to prevent twine breakage, is provided which serves to maintain the tautness in a length of twine 12 moving along a path of travel. The tensioning device presents a pair of relatively spring-loaded nip rollers 18, 22 mounted to engage the twine such that the twine follows a serpentine path of travel through the rollers. Advantageously, the movable roller 22 of the pair is mounted on a bracket 24 for pivotal movement about a pin 58 in the general direction of the twine path of travel, thereby allowing passage of knots in the twine without twine breakage, while maintaining tension on the twine traveling to the knotting mechanism 16.

**Fig.1.**



**GB 2 141 664 A**

**Fig. 1.**

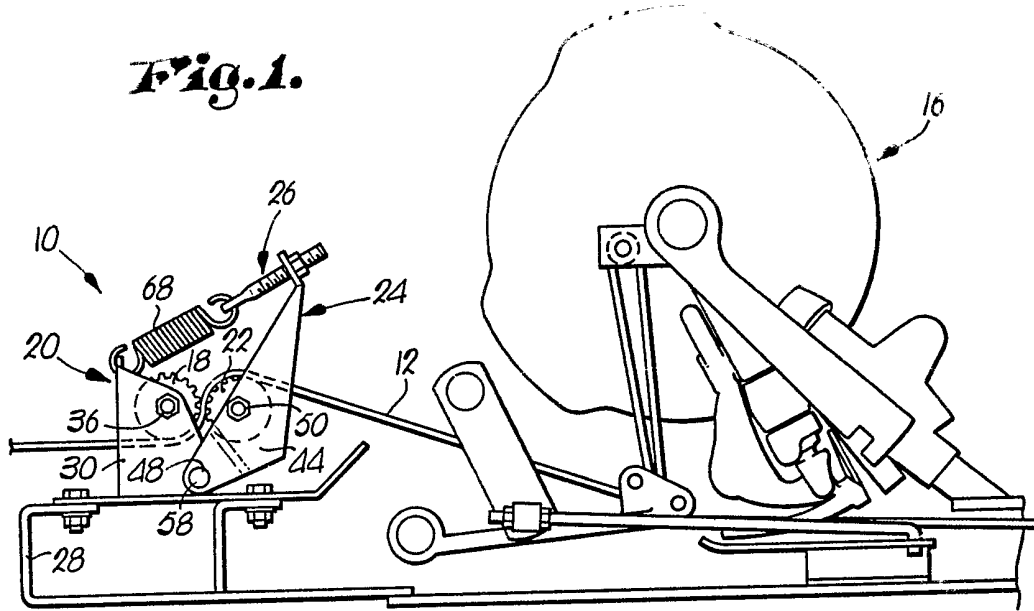


**Fig. 2.**

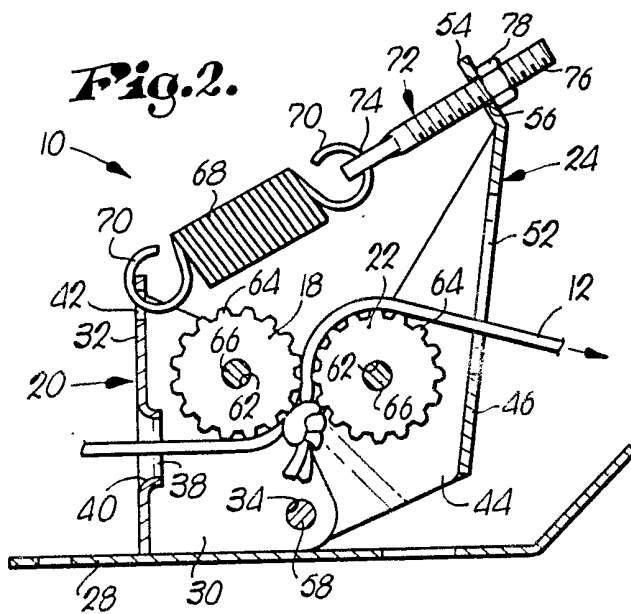


**Fig. 3.**

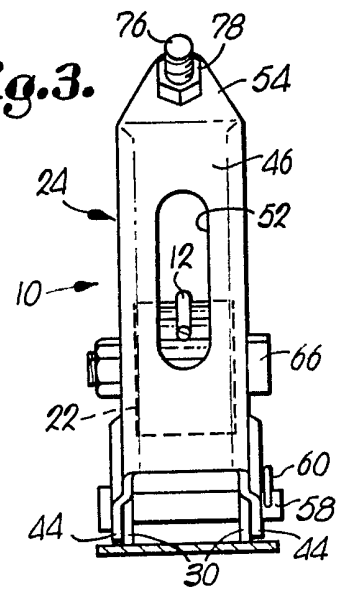
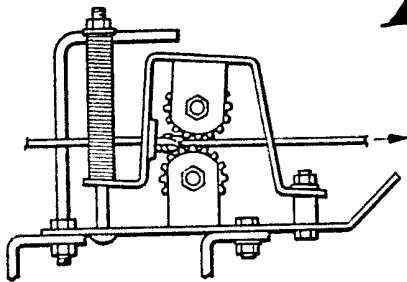
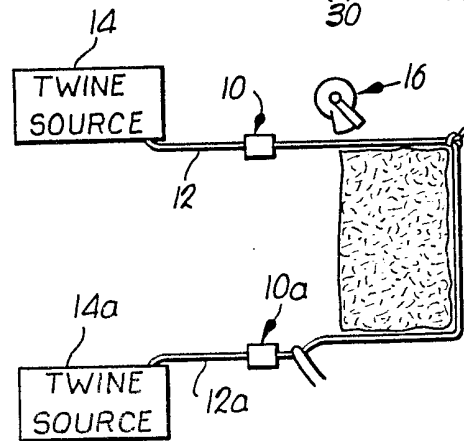


**Fig. 4.**



PRIOR ART

**Fig. 5.**

## SPECIFICATION

### Twine tensioner for crop baler knotter

#### 5 *Background of the Invention*

##### 1. *Field of the Invention*

This invention relates to a twine tensioning device especially designed for use in crop balers, which has numerous advantages including easy adjustability of the tensioning force and the easy passage of twine knots therethrough without breakage of the twine.

##### 2. *Description of the Prior Art*

As those familiar with the farm implement art will appreciate, it is necessary in balers or in similar implements using twine in their operation, to convey the twine from its source to an operative mechanism under tension. For example, in a hay baler twine is wrapped around a bale and knotted to maintain the integrity of the completed bale. In a typical hay baler the twine source is usually a loosely mounted ball of twine which allows the twine to freely unravel. In such a baler, the twine normally follows an indirect path from the ball to a knotting mechanism. Although the positioning of the twine source relative to the knotter varies a great deal, it is necessary in any event to maintain the twine taut along this path of travel. This tension in the twine is necessary to properly feed the knotter and to prevent the twine from straying from its path of travel into unwanted areas of the implement.

Twine tensioners have been proposed in the past (see Fig. 5) which adequately maintain the tension in the twine under many conditions. However, such past devices are deficient in a number of respects. As those skilled in the art will appreciate, the twine in hay balers does not move at a constant velocity along its path of travel. Rather, twine exhibits erratic movement, surging forward at times to meet the needs of the hay bale knotting mechanism. Additionally, the several balls of twine carried on a baler are knotted together at their ends in order to provide a continuous strand for presentation to the knotter.

Turning to Fig. 5, a tensioning device used in the past is shown. The device encompasses two rollers vertically disposed above and below a horizontal twine path of travel. In such a device, the twine is compressed in the nip between the two rollers with the rollers engaging the twine at the same general location. Although one of the rollers is shiftable relative to the other roller (the top roller in Fig. 5), this arrangement has sometimes proven ineffective in passing many of the twine knots through the rollers. That is, if the compression between the rollers is relaxed sufficiently to pass the majority of the twine knots, the twine is not adequately tensioned along its path of travel for normal operations. On the other

hand, if such a device is adjusted to maintain adequate tension, many of the twine knots will not pass through the device. Thus, with the twine surging forward along its path of travel (left to right viewing Fig. 5), when a knot encounters the nip between the rollers, the tensile surge force of the twine is concentrated in the area of the knot with the twine often breaking at the knot before the upper roller transversely yields for knot passage. At other times, when the knot encounters such a tensioning device, the twine is pulled out of the knotting mechanism.

The need for proper twine tension is especially acute in balers employing "double knotters" wherein the twine is under relatively low tension throughout the baling cycle because it is not pulled through the tight interface between abutting bales (see, for example, U.S. Letters Patent Nos. 4,074,623, 4,108,062 and 4,142,746). Yet, in order for the knotter to function properly, the twine must be taut to a certain minimum extent.

#### 90 *Summary of the Invention*

The problems outlined above are in large measure solved by the twine tensioning device in accordance with the present invention. That is, the device hereof provides adequate tension to the twine under all conditions and further allows passage of twine knots without the breakage of the twine or pulling the twine out of the knotting mechanism.

The twine tensioning apparatus of the present invention broadly includes a pair of juxtaposed members for operably engaging twine moving along a path of travel, means mounting one of the members for separating movement away from the other, and means for directing the twine away from the members in the general direction of their separating movement in such a manner that the twine is partially entrained around the movable member. Preferably the members comprise first and second, circular in crosssection, rollers and each roller preferably presents a plurality of outwardly extending teeth.

In particularly preferred forms, the first roller is fixed in location while the second roller is pivotally mounted in a first direction relative to the first roller to permit the second roller to pivot towards and away from the first roller. Additionally, the twine passes through the nip between the rollers, is partially entrained (or wrapped) around the second roller and finally travels away from the second roller, exits the tensioning device generally in the first direction. This positioning of the second roller relative to the direction of movement of the twine allows the second roller to be easily displaced away from the first roller for passage of twine knots without applying the twine tensioning force entirely to the knot location. Thus, twine tension is maintained and twine knots passed through the tension-

ing device without twine breakage or pulling the twine out of the knotting mechanism.

#### *Brief Description of the Drawing*

5 Figure 1 is a side elevational view of a twine tensioner in accordance with the present invention and additionally depicts a conventional hay bale knotting mechanism disposed downstream of the tensioner;

10 Fig. 2 is an enlarged, vertical sectional view of the tensioner hereof;

Fig. 3 is an elevational view of the twine outlet side of the device hereof;

15 Fig. 4 is a schematic view illustrating the relative disposition of two tensioning devices of the invention hereof in use with a double knotter of the type disclosed in the aforesaid patents; and

20 Fig. 5 is a side elevational view of a prior art twine tensioning device.

#### *Description of the Preferred Embodiment*

Referring now to the drawing, a twine tensioning device 10 for tensioning elongated  
25 twine 12 moving along a path of travel is illustrated. The device 10 is mounted on the wall 11 of a crop baler disposed along the path of travel of the twine 12 intermediate a twine source 14 and a knotting mechanism  
30 16. The device 10 has particular utility in connection with a "double knotter" as in the aforesaid patents, and for purposes of illustration herein, the mechanism 16 has been shown as comprising the double knotter type.  
35 Fig. 4 illustrates that a second device 10a, twine 12a, and twine source 14a are used under those circumstances.

The twine tensioning device 10 broadly includes a generally circular in cross-section  
40 first roller 18, first roller mounting bracket 20, a generally circular in cross-section second roller 22, shiftable second roller mounting bracket 24, and spring biasing structure 26 for biasing the second roller 22 towards  
45 first roller 18.

In more detail, the crop baler presents an upright, horizontally oriented mounting frame 28 as seen in Fig. 1. The first roller mounting bracket 20 is generally U-shaped in cross-section to present a pair of upright, flattened,  
50 spaced-apart side plates 30 interconnected by a bight in the form of a flattened inlet face plate 32. As seen in Figs. 1-2, the bracket 20 is fixedly connected to the mounting frame 28 (as by welding). Each side plate 30 includes a lowermost transverse aperture 34 and an upper transverse aperture 36. The apertures 34,  
55 36 of one side plate 30 are respectively aligned with the apertures 34, 36 of the opposed side plate 30. Inlet face plate 32 includes a lower circular inlet passage 38 beveled as at 40 and an uppermost aperture 42.

The second roller mounting bracket 24 is  
65 similarly configured to the first bracket 20 in

that it presents a generally U-shaped in cross-section, clevis configuration. That is, the bracket 24 presents a pair of flattened, spaced-apart side plates 44 interconnected at one end by a bight in the form of an outlet face plate 46. Each side plate 44 presents a lowermost transverse aperture 48 and an uppermost transverse aperture 50. The apertures 48, 50 of one side plate 44 are respectively  
70 aligned with the apertures 48, 50 of the opposed side plate 44. A predominant feature of the outlet face plate 46 is a vertically elongated outlet slot 52 extending there-through. Additionally, the outlet face plate 46 presents at the upper end thereof an intumed connection portion 54 apertured as at 56.

The bracket 24 is pivotally interconnected to the bracket 20 as shown in Figs. 1-3. To this end, the bracket 24 is positioned relative  
85 to the bracket 20 with the side plates 44 positioned outboard in adjoining relationship to the side plates 30 in such a manner that the respective apertures 48, 34 are aligned. An elongated cylindrical pin 58 extends  
90 through the aligned apertures 48, 34 and is removably secured as by cotter key 60 (see Fig. 3).

As seen in Fig. 2, the first and second rollers 18, 22 are similarly configured and dimensioned. That is, each roller 18, 22 is circular in cross-section and presents a centrally located elongated bore 62 extending  
95 therethrough. Further, each roller presents a plurality of radially outwardly extending teeth 64 circumferentially spaced around the arcuate surface of each roller. Each roller 18, 22 is mounted to its respective bracket 20, 24 by an elongated axle 66 (threadingly secured by a nut at one end thereof). Thus, first roller 18  
100 is disposed between respective side plates 30 in such a manner that the bore 62 is aligned with the apertures 36. The axle 66 extends through the bore 62 and aligned apertures 36 rotatably securing the roller 18 in a fixed  
110 location. Similarly, the roller 22 is rotatably secured between the side plates 44. That is, with the apertures 50 aligned with the bore 62, the axle 66 extends therethrough.

Biasing structure 26 generally comprises a coil tension spring 68 having a pair of hooks 70 at opposite ends thereof, and an eye-bolt 72 presenting an aperture 74 at one end and threaded at the other end as at 76. As seen in  
115 Figs. 1-2, the biasing structure interconnects the uppermost ends of the respective brackets 20, 24 thereby biasing the roller 22 towards first roller 18. To this end, hook 70 is passed through aperture 42 of the inlet face plate 32 while the opposite hook 70 passes through  
120 the aperture 74 of eye-bolt 72. The threaded end 76 of eyebolt 72 passes through the aperture 56 of connection member 54 and is secured by nut 78, the latter permitting adjustment of the biasing force from spring 68  
125 as well as attaching the same to bracket 24.

In use, the device 10 is mounted along the path of travel of twine 12 generally upstream between the knotter 16 and twine source 14. As will be appreciated, the twine source 14 is typically a wound ball of twine and advantageously the device 10 has proven equally effective with all types of twine (sisal, plastic, etc.).

Viewing particularly Fig. 2, the path of travel of the twine 12 follows an approximately serpentine path through the device 10 and may, if desired, enter and exit the device 10 in the same general direction (horizontally left to right in the drawing). Thus, the twine 12 passes through the inlet passage 38 and then passes upwardly between the nip between the rollers 18 22 before exiting through the slot 52.

While passing through the nip, the twine 12 is simultaneously engaged at the same location by the respective rollers 18, 22 (albeit on opposite sides of the twine 12). After exiting the nip, the twine passes along an arcuate path and is partially entrained over the generally uppermost surface of the second roller 22 to the extent of greater than one radian. As can be appreciated from Fig. 2, when a knot is presented at the nip between the rollers 18, 22 the tensile force of the twine 12 moving in its path of travel is distributed not only at the knot, but additionally over the upper left quadrant of the arcuate surface of the second roller 22. Further, biasing structure 26 and the pivotal mounting of the bracket 24 allows the roller 22 to yield generally in the direction of the force applied thereto. This combination of force distribution and mechanical advantage allows the device 10 to pass a knot therethrough without breaking the twine 12, pulling the twine 12 out of knotter 16, or relieving the tension thereon. As may be appreciated, although the illustrated embodiment shows the twine 12 entering the device 10 through inlet passage 38, it is equally effective as an alternative to have the twine 12 enter the device 10 upwardly from an inlet passage in the mounting frame 28 towards the nip between the rollers 18, 22.

#### CLAIMS

1. A twine tensioning apparatus, comprising:

a pair of juxtaposed members for operably and compressibly engaging an elongated twine moving along a path of travel passing between said members, in order to apply tension to said twine;

means mounting said members for allowing relative shifting movement of said members towards and away from each other and for biasing said members towards each other; and

means for directing said twine away from said members in the general direction of separating movement of one of said members

from the other for causing the twine to partially entrain said one member to facilitate said separating movement of said one member by the moving twine when a knot or the like therein attempts to enter the nip between the members on the upstream side thereof.

2. A tensioning device as set forth in Claim 1, said members comprising a pair of circular in cross-section rollers.

3. A tensioning device as set forth in Claim 2, said rollers each presenting a plurality radially outwardly extending teeth.

4. A tensioning device as set forth in Claim 1, one of said members being fixed in location, and said other member being pivotally coupled relative said one member thereby permitting said other member to pivot towards and away from said one member.

5. A tensioning device as set forth in Claim 2, wherein said directing means are disposed to cause the twine to engage said one member along a circumferential distance greater than one radian.

6. A twine tensioning device comprising: structure defining a twine inlet; a first roller; means mounting said first roller; a second roller; means shiftably mounting said second roller

in a location normally adjacent and generally in a first direction relative to said first roller for permitting lateral shifting of said second roller relative to said first roller;

means biasing said second roller towards said first roller; and

structure defining a twine outlet generally in said first direction relative to said second roller.

7. A twine tensioning device as set forth in Claim 6, said rollers each presenting a plurality of radially outwardly extending teeth.

8. A twine rope tensioning device as set forth in Claim 6 said second roller mounting means being pivotally connected relative said first roller.

9. A twine tensioning device as set forth in Claim 6, said rollers being circular in cross-section and said second roller being mounted to engage a twine traveling along a path of travel between said twine inlet and said twine outlet for a distance greater than one radian.

10. A twine tensioning device as set forth in Claim 6, said biasing means including means for varying the biasing force applied to said second roller.

11. In a crop baler, the combination comprising:

elongated twine disposed in a path of travel;

a first member mounted on one side of said path of travel;

a second member mounted on the other side of said path of travel;

means mounting said members adjacent one another for permitting relative shifting

movement of said second member towards  
and away from said first member;

means biasing said members towards each  
other; and

- 5 means for guiding said twine away from  
said second member in the general direction  
of shifting movement of said second member,  
and for tensioning said twine away from said  
second member, wherein said twine is par-  
10 tially entrained around said second member  
for facilitating shifting movement of said sec-  
ond member when encountering a knot in the  
twine.

12. In a baler as set forth in Claim 11, said  
15 members comprising a pair of circular in  
crosssection rollers.

13. In a baler as set forth in Claim 12,  
wherein said second roller engages said twine  
along a circumferential distance greater than  
20 one radian.

14. In a baler as set forth in Claim 11, said  
members being mounted for simultaneous en-  
gagement with said twine at a first location  
and said second member engaging said twine  
25 additionally at a second location remote from  
said first location.

15. In a baler as set forth in Claim 11, said  
first member being mounted in a fixed posi-  
tion and said second member being adjusta-  
30 bly mounted in juxtaposition relation to said  
first member for variable movement between  
said members.

16. In a baler as set forth in Claim 11, said  
path of travel lying in a serpentine relation to  
35 said members with said twine passing through  
the nip between said members.

17. In a baler as set forth in Claim 11, said  
second member being adjustably biased to-  
wards said first member.

- 40 18 A twine tensioning apparatus as herein-  
before described with reference to the accom-  
panying drawings.

19. In a crop baler, the combination as  
hereinbefore described with reference to the  
45 accompanying drawings.