United States Patent [19]

Freeman

[11] **3,863,850**

[45] **Feb. 4, 1975**

[54] **BALE SHREDDER AND DISCHARGER**

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[52] **U.S. Cl.**..... **241/186 R,** 241/101.7, 241/186.4

[51] **Int. Cl.** **A01f 29/00**

[58] **Field of Search**..... 241/186 R, 186.9, 101 A, 241/101 M

[56] **References Cited**

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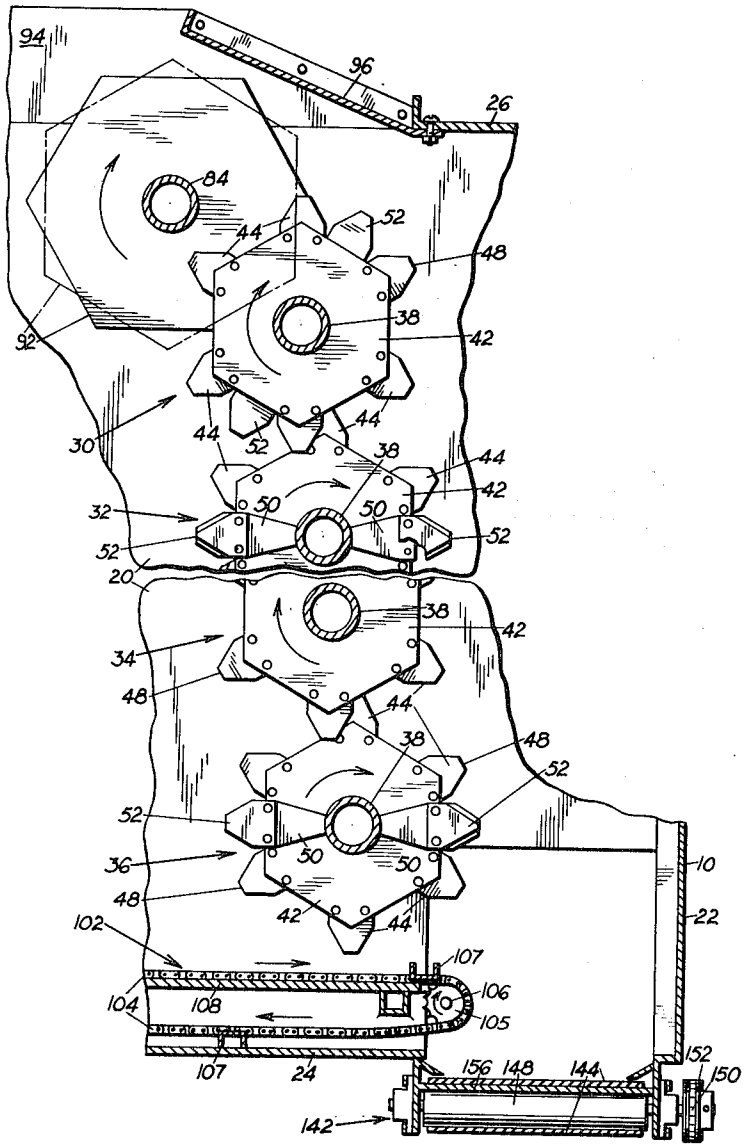
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Primary Examiner—Granville Y. Custer, Jr.
Assistant Examiner—E. F. Desmond
Attorney, Agent, or Firm—Eugene M. Eckelman

[57] **ABSTRACT**

A device mounted on a trailer or self-powered vehicle having a bin for receiving a supply of bales. A plurality of lateral, driven shafts adjacent the front of the bin carry knife assemblies for cutting and shredding baled hay or the like. A longitudinal conveyor on the bottom of the bin carries the bales into the knife assemblies. A plurality of leveling wheels are provided at the top and rearward of the knife assemblies for holding the hay in the knife assemblies as it is being shredded.

7 Claims, 8 Drawing Figures



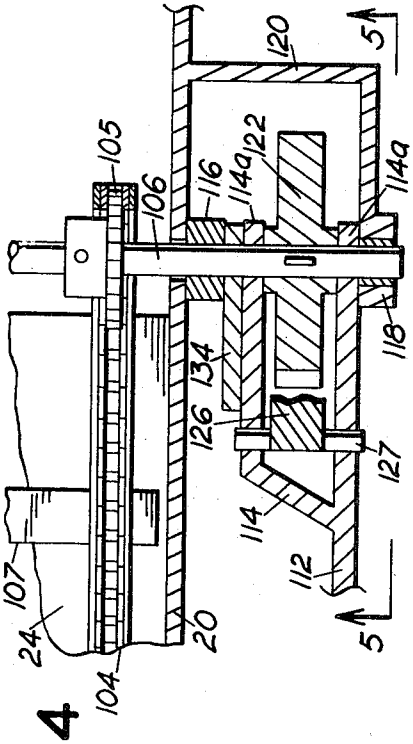


FIG. 4

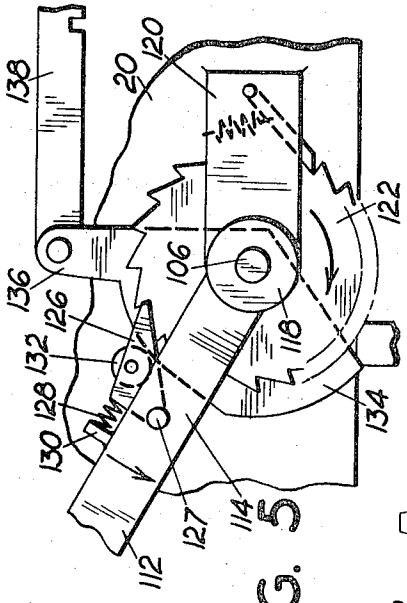


FIG. 5

FIG. 1

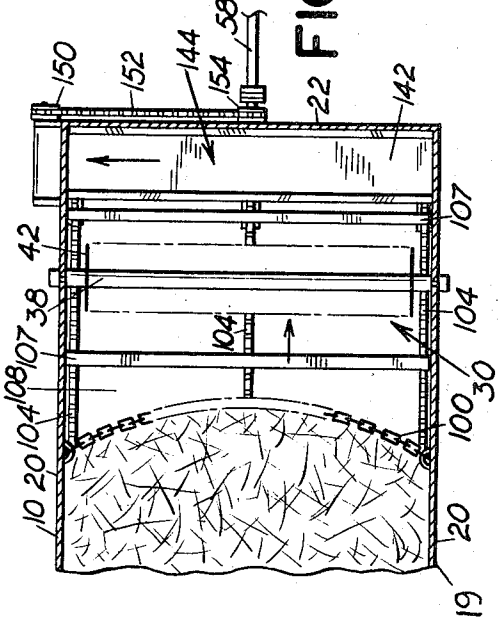


FIG. 6

FIG. 2

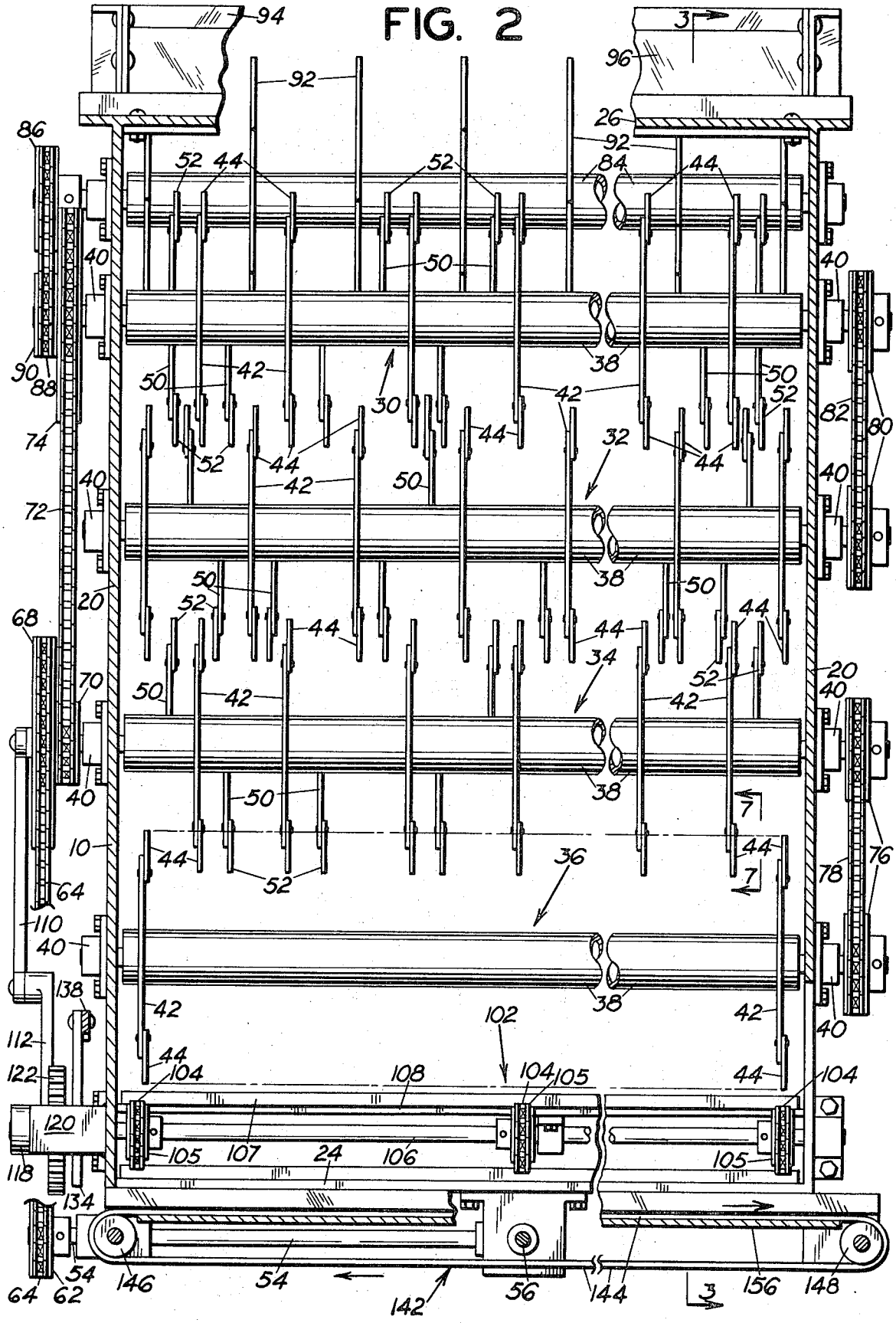

94
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112
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148
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FIG. 3

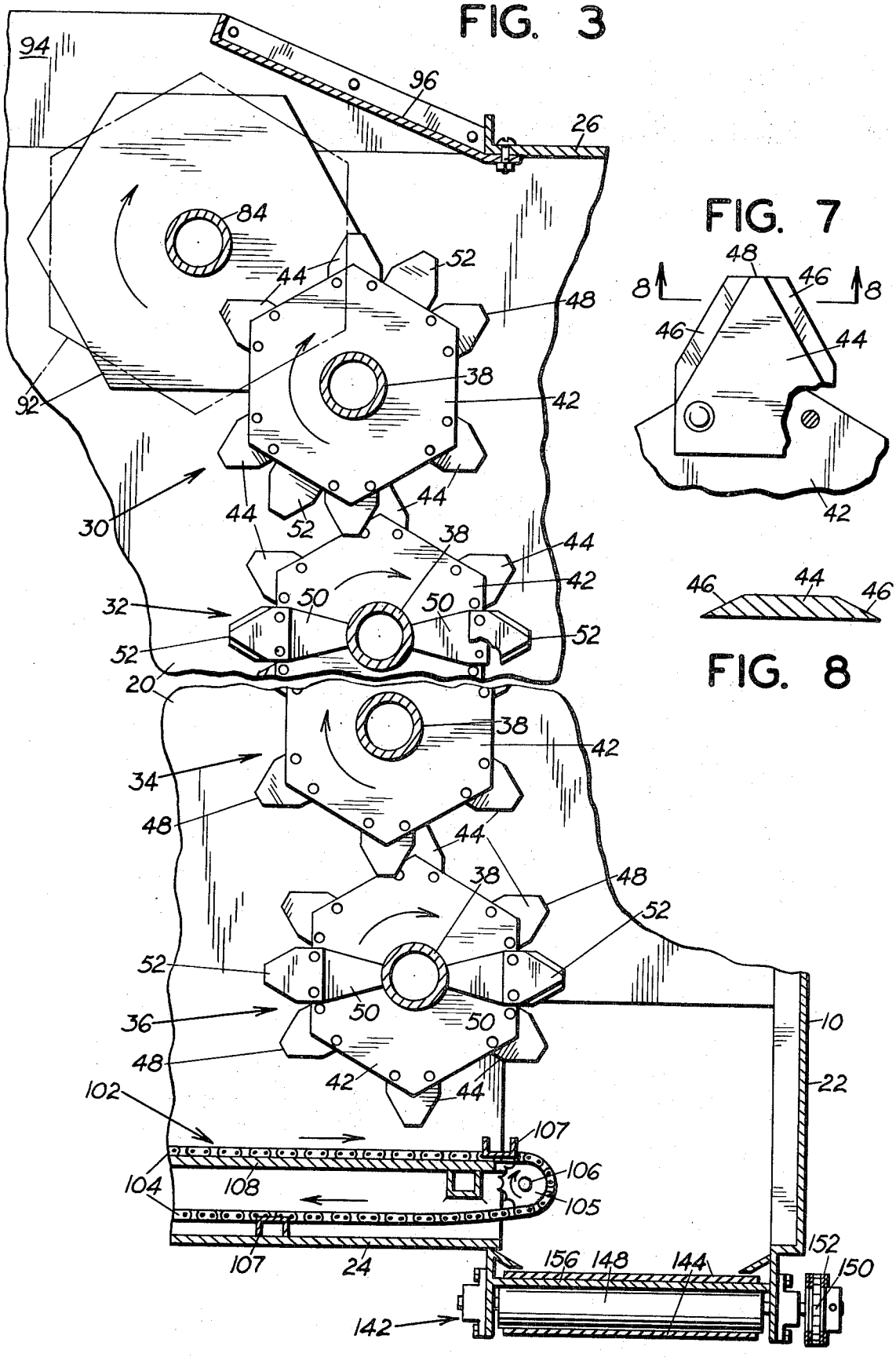


FIG. 7

FIG. 8

BALE SHREDDER AND DISCHARGER

BACKGROUND OF THE INVENTION

This invention relates to new and useful improvements in bale shredders and dischargers.

Vehicles have heretofore been employed which carry baled materials, such as hay, to a location for consumption by livestock. Such devices employ a longitudinally operating conveyor which carries the bales into laterally extending knife assemblies, and these knife assemblies shred the baled material and deposit it in loose condition off to one side of the vehicle. In my U.S. Pat. No. 3,530,912, I provide a bale shredder and discharger which utilizes a longitudinally extending conveyor and which also utilizes laterally extending knife assemblies for shredding the baled material. A plurality of knife assemblies are provided from top to bottom of the bin, with each upper assembly being disposed rearwardly from the assembly thereunder. It has been found that since the knives rotate forwardly relative to the bin the baled material will climb up over the knife assemblies rather than being efficiently shredded, even though the upright alignment of the knife assemblies is inclined rearwardly.

SUMMARY OF THE INVENTION

According to the present invention and forming an important objective thereof, there is provided a bale shredder and discharger mechanism having an arrangement of knife assemblies and leveling wheels which accomplishes a faster and more efficient shredding of baled material than devices heretofore employed.

More particular objects of the present invention are to provide a bale shredder and discharger mechanism which in addition to employing a plurality of shaft mounted knife assemblies employs top leveling wheels disposed rearwardly of the uppermost knife assembly and driven at a slower speed than the knife assemblies so as to hold the bales in the wheels to provide a fast and efficient shredding; to provide novel cutting and shredding teeth on the knife assemblies; and to provide an upper flexible cross link that causes a re-working of partially shredded material.

The invention will be better understood and additional objects and advantages will become apparent from the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view showing a trailer device having the present bale shredder and discharger mechanism incorporated therein;

FIG. 2 is an enlarged vertical foreshortened sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a foreshortened fragmentary sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view taken on the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary elevational view taken on the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary sectional view taken on the line 6—6 of FIG. 1;

FIG. 7 is an enlarged fragmentary elevational view, partly broken away, of a knife unit, taken on the line 7—7 of FIG. 2; and

FIG. 8 is a sectional view taken on the line 8—8 of FIG. 7.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The apparatus of the invention may be mounted on any suitable vehicle such as for example a trailer **10** which may be transported by a suitable vehicle such as a tractor **12** having a power take-off shaft **14.** The trailer has a suitable chassis frame supported on the usual pair of rear wheels **16** and forward steering wheels **18.** The vehicle **10** could as well comprise a truck having a power take-off shaft from the truck transmission.

The body of the trailer **10** comprises a rectangular bin **19** capable of holding a considerable number of bales. The bin **19** has side walls **20,** a front wall **22,** a bottom wall **24,** and a top wall **26,** the rear of the trailer being open and adapted to receive bales. If the bales are tied by twine no prior treatment is required. However, if they are tied by wire the wire on each bale should be clipped first before the bale is dumped into the bin.

A plurality of horizontal, transversely mounted rotating knife assemblies, FIGS. **2** and **3,** extend across the inside of the bin near the front. In the particular arrangement illustrated, there are four knife assemblies one above the other and designated generally from top to bottom by the numerals **30, 32, 34** and **36.** Each knife assembly consists of a cross shaft **38** the ends of which are mounted in bearings **40** supported on opposite side walls **20** of the bin. As best seen in FIG. **3,** and also FIG. **1,** the shafts **38** above the lower shaft are spaced progressively rearwardly so that an upright line through the shafts is inclined to the rear.

Each shaft **38** has a plurality of main knives thereon comprising a non-round bracket plate **42** secured integrally to the shaft. A preferred shape of such plates is octagonal with a knife blade **44** secured to each point or peak of the plates. The structure of the knife blades is shown in detail in FIGS. **7** and **8.** Such blades have a pair of side cutting edges **46** leading to a blunt outer edge **48.**

The knife assemblies also include auxiliary knife blades between the main knives, and these auxiliary blades include a radial arm **50** supporting a knife blade **52** thereon of the same structure as the knife blades **44.** The bracket plates **42** are spaced laterally on their shafts **38** as shown in FIG. **2,** and the auxiliary arms **50** are spaced therebetween to provide a reduced spacing between the knife blades and thus provide a good shredding function. The knife blades overlap vertically a short distance as apparent in FIG. **2** and are arranged to break up the bales. The number of auxiliary knives on the shafts increases progressively from bottom to top since the greater shredding action occurs at the upper portion of the bin. While the knives perform mainly a shredding operation, some actual cutting will take place if the material offers resistance to shredding for one reason or another.

The knife assemblies **30, 32, 34** and **36,** as indicated in FIG. **3** and as also apparent in FIG. **1,** are all rotated in the same direction, namely, clockwise as viewed in these figures. The assemblies are driven by sprocket and chain connections from a bottom cross shaft **54** which is driven through suitable gearing from a centrally located and longitudinally extending main shaft **56** which is connected with the power take-off **14** on the tractor through the medium of a connecting assem-

bly **58** comprising splined telescoping elements and universal joint connections which are well known in the art and which need to be described since they do not constitute part of the present invention. The trailer is attached to the tractor by a conventional tongue assembly **60** in a well known manner.

A sprocket **62**, secured on one outer end of shaft **54**, is connected by a sprocket chain **64** with a sprocket **68** secured on the end of shaft **38** of the knife assembly **34**. This shaft end has a second sprocket **70**, FIG. **2**, connected by a sprocket chain **72** to a sprocket **74** on a projecting end of the shaft **38** of the knife assembly **30**. This arrangement provides a drive for the shafts **38** of knife assemblies **34** and **30**. Shafts **38** of knife assemblies **34** and **36** project from the other side of the bin from the sprocket **62** and a drive connection between these two shafts is accomplished by sprockets **76** on such projecting ends connected by a sprocket chain **78**. A similar connection is established between the shafts **38** of knife assemblies **30** and **32** by sprockets **80** connected by a sprocket chain **82**.

The sprocket and sprocket chain connections between the shafts of all four knife assemblies is such that the shafts rotate at the same speed.

A shaft **84**, FIGS. **1**, **2** and **3**, projects laterally across the bin above the uppermost knife assembly **30** and rearwardly thereof. This shaft is journaled in the side walls of the bin and one end thereof projects on the drive side of the knife assembly and has a sprocket **86** connected by means of a sprocket chain **88** to a sprocket **90** on the shaft **38** of knife assembly **30**. The arrangement between sprockets **86** and **90** is such that the shaft **84** will rotate slower than the knife assembly shafts, for example, about one-third, and in the same direction. Integrally carried on the shaft **84** is a plurality of non-round wheels **92** such as octagonal shape. These wheels are evenly spaced across the shaft **84** and thread between the knife blades **44** and **52** in the knife assembly **30**. Adjacent wheels **92** have a staggered rotated position on the shaft **84** as shown in full and phantom lines in FIG. **3**. The operation of the wheels **92** will be explained in greater detail hereinafter.

The top wall **26** of the bin has a raised portion **94** which extends the full width of the bin and longitudinally extends a short distance forward and rearward of the wheels **92**. The front wall **96** of the raised portion **94** is angled downwardly toward the front and consists of a heavy plate structure capable of withstanding pressure exerted by shredded material which may move off the wheels **92**.

Connected between the inner sides of the bin side walls **20** is a flexible line or link **100** such as a chain. This line is located selectively in the bin, namely, 2 or 3 feet rearwardly of the wheels **92** and a short distance, namely, about 1 foot, below the top of the bin. The specific location of the line **100** is not critical except that it be close to but rearwardly of the knife assemblies and located toward the top of the bin. The function thereof will be described hereinafter.

An endless conveyor assembly **102** is mounted at the bottom of the bin and operates to move bales supported thereon forwardly to the knife assemblies. This conveyor assembly includes three identical endless sprocket chains **104**, FIGS. **1**, **2** and **3**, operating over end sprockets **105** on shafts **106**. Sprocket chains **104** are connected at regular intervals by transverse channel bars **107**. The upper course of the conveyor assembly moves along a supporting platform **108** spaced a slight distance above the bottom **24** of the bin (shown best in FIG. **3**) and which in effect constitutes an inner floor of the bin up to the front but terminating about at the forward end of the endless conveyor, the conveyor assembly extending from the rear of the bin to a position short of the front wall **22** but fully under the knife assemblies. The conveyor assembly **102** is driven at adjustable speed with respect to the rotating knife assemblies through means which will now be briefly described.

A link **110**, FIGS. **1** and **2**, has one end pivotally connected to an outer or eccentric point on sprocket **68** and has its other end pivotally connected to a rod **112** pivotally connected to one end of a compound forked lever arm **114**, FIGS. **4** and **5**, the inner forked ends **114a** of which are rotatably supported on a projecting end portion of front shaft **106**. The projecting end portion of the shaft **106** is rotatably supported in a journal **116** supported on a side wall **20** of the bin and in an outer journal **118** in a bracket **120** welded to the bin wall. A ratchet wheel **122** is keyed on the shaft **106** inside the bracket **120** and is positioned between the forks **114a** of the compound forked lever arm **114**.

A pawl **126**, carried on a pivot shaft **127** supported in the forks **114a**, is so arranged as to engage teeth on the ratchet wheel **122**. The pawl **126** is spring pressed by a coil spring **128** supported against a lug **130** mounted on the lever arm **114**. The pawl **126** carries a cam roller **132** which rides on the cam periphery of a disc **134** rotatably supported on the shaft **106**. The cam disc **134** has an arm **136** to which an adjusting bar **138** is connected. This bar is slidably mounted on a bracket **140**, FIG. **1**, on the side of the bin, and the bottom edge thereof adjacent its free end is provided with a series of notches so arranged as to engage the bottom of the bracket and thereby hold the adjusting bar **138** and therewith the cam disc **134** in a desired position. The cam disc **134**, through the intermediary of the cam roller **132** controlling the pawl **126**, determines the number of ratchet teeth which the pawl will engage with each upward movement of the lever arm **114**. It therefore determines the speed of rotation of the ratchet wheel **122** and therewith of the shaft **106** and conveyor assembly **102** with each rotation of the shaft **38** of the knife assembly **34**.

The bottom wall **24** of the bin is discontinued beyond the lower knife assembly **36** and at the front termination of the conveyor assembly **102**. Below this open bottom area is a cross conveyor **142**, FIGS. **1**, **2** and **3**, consisting of an endless belt **144** passing around end rollers **146** and **148** supported in suitable bearings mounted below the bottom of the bin at the opposite sides respectively. A sprocket **150** is secured to the shaft on which the end roller **148** is secured, and an endless sprocket chain **152**, FIG. **6**, connects the sprocket **150** with a sprocket **154** secured on the central main drive shaft **56** which is connected with the power take-off shaft from the tractor. The upper course of the cross conveyor **142** slides along a support platform **156** which is mounted beneath the bin in any suitable manner (not shown). The shredded material delivered onto the cross conveyor belt **144** is thereby discharged from the side of the trailer at the front.

Thus, the rotating knife assemblies **30**, **32**, **34**, and **36**, the conveyor assembly **102** by which the bales in the bin are moved into contact with the knife assem-

blies, and the cross conveyor **142** which receives the material discharged from the knife assemblies and from the conveyor **102,** are all driven through the intermediary of various means connected with the central main drive shaft **56** as herein described.

In the operation of the device, the bales which are dumped into the rearward end of the bin are moved forwardly at a predetermined rate of speed until they encounter the rotating knife assembly. With the device operating at substantially full capacity, namely, with about three layers of bales moving into engagement with the knife assemblies, the knives will break up the bales with the result that some of the loosened and shredded material is thrown upwardly and forwardly causing it to drop down and fall onto the front cross conveyor **142.** However, some of the material from the upper bales will require further loosening and shredding and it will drop down on and become mixed in with the bales in the next layer as these latter encounter the knives in the next lower knife assembly **32.** The knives in the knife assembly **32** act similarly on the bales in the second layer and so on down whereby the shredded or loosened material is deposited on the cross conveyor **142.**

As stated, it is preferred that the knife assemblies be positioned in a slightly forwardly sloping line, and this will act partly to keep the material from walking upwardly. However, some of such material tends to work upwardly and when it does it encounters wheels **92.** These wheels, being disposed rearwardly of the top knife assembly **30** and rotating at a slower speed than the knife assemblies, provide a resistance to the material from going over the top so that a good shredding is accomplished. Some of the material may be shredded between the wheels **92** and the uppermost knife assembly **30** and will pass therebetween so as to fall on the cross conveyor **142.** Raised portion **94** of the bin allows shredded material to go over the top of the wheels.

As the material is being shredded by the knife assemblies and by the wheels **92** and as it bunches rearwardly at the top, it will be supported on the flexible line **100** as the center thereof and rotate therearound to provide a better and faster shredding.

The speed of the conveyor **102** is preselected by a setting of the adjusting bar **138.** Such adjustment is made to accomplish the most efficient feeding of the bales to the knives. That is, if it is found that the material is accumulating at the knives and is bunching up too much, the conveyor can be slowed down. The shape of the knife blades **44** and the supporting bracket plates **42** therefor as well as the use of the leveling wheels **92** provides for a preferred shredding of the material. Although the invention is described as being used with baled material, it can of course be used with unbaled material where it is desired that such unbaled material be loosened even more, or simply to provide a dispensing vehicle for material.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. A device for shredding baled material comprising:

a. a bin for receiving bales to be shredded,

b. a plurality of power driven rotating knife assemblies in said bin disposed one above the other and each including a cross shaft and radially extending knife blades projecting therefrom,

c. conveyor means arranged to feed bales into said knife,

d. a power driven cross shaft above the uppermost shaft of the knife assemblies,

e. and a plurality of wheels on said last mentioned shaft,

f. said wheels projecting radially beyond the uppermost knife blades with relation to the side from which the bales are fed by said conveyor means,

g. said wheels being non-round so that their peripheral edges provide abutment for material which has worked up on the knife assemblies in a shredding operation whereby the material is held down for efficient shredding.

2. The device of claim **1** wherein said wheels rotate in the same direction as the uppermost knife blades.

3. The device of claim **1** wherein said wheels rotate in the same direction as the uppermost knife blades and at a slower speed.

4. The device of claim **1** wherein upper ones of said cross shafts have a greater number of knife blades than lower ones of said cross shafts.

5. The device of claim **1** wherein said wheels have adjacent flat edge portions with peaks therebetween to form said non-round shape.

6. The device of claim **1** wherein said wheels are hexagonal to form said non-round shape.

7. The device of claim **1** including a flexible cross link secured across said bin rearwardly adjacent to said wheels and at an upper portion of the bin to provide a support for material being shredded in the area of said wheels.

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