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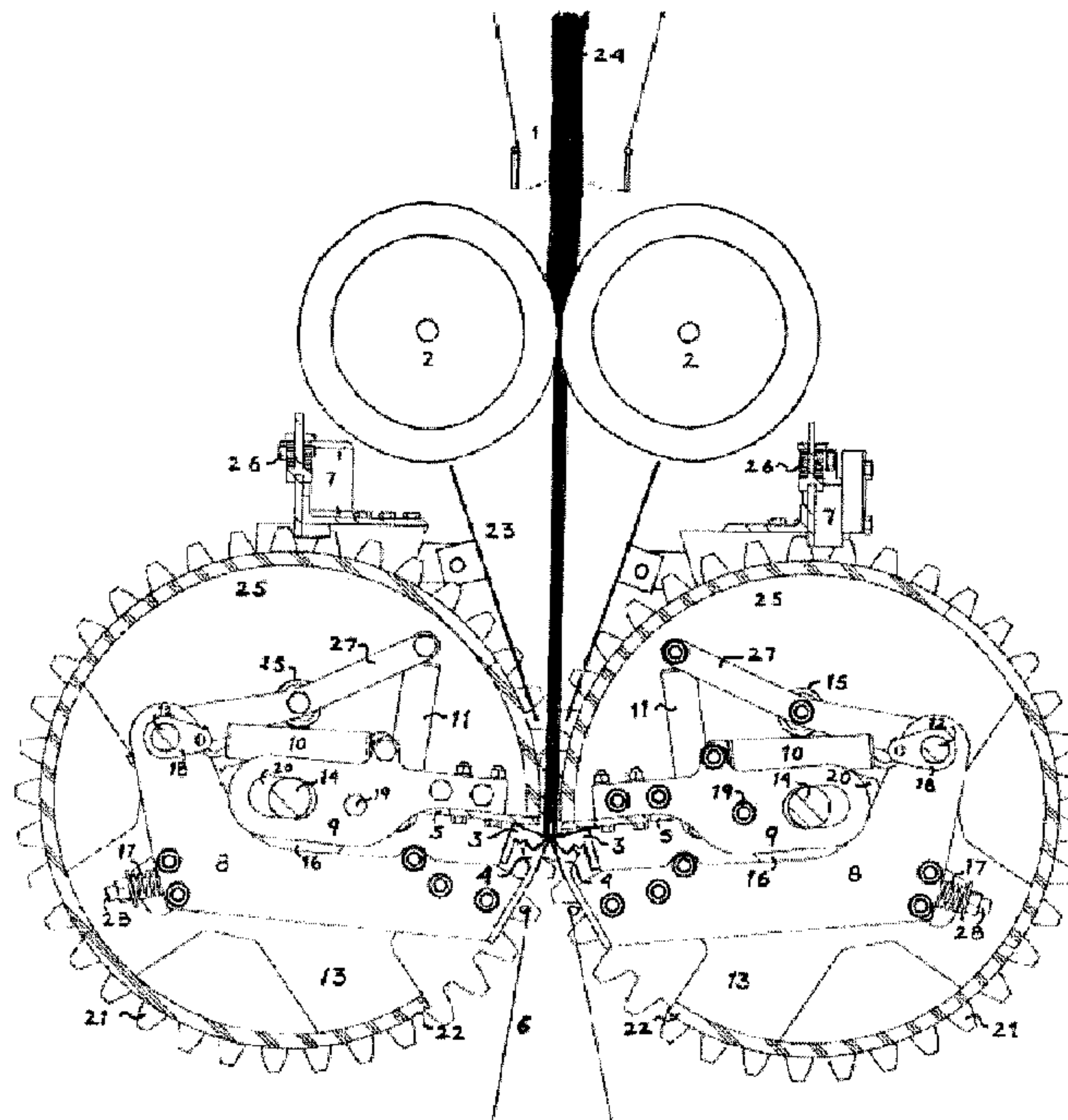
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VERTES FIBREUSES

(54) Title: RIBBON DECORTICATION APPARATUS AND METHOD FOR PROCESSING GREEN FIBROUS PLANT
STALKS



(57) Abrégé/Abstract:

Methods and systems for decortivating fibrous plant stalks are disclosed. One such system includes a pair of rotatable drums. Each drum is coupled to a frame and positioned to form a gap between the drums for receiving a stalk for peeling. A pinch anvil is coupled to each drum for pinching the plant stalk adjacent an end of the plant stalk. Pinching the plant stalk severs an inner core of the plant stalk while leaving an outer bast intact and splays portions of the plant stalk at the end. A grab bar is coupled to each drum for holding one or more of the splayed portions of the plant stalk. Rotation of the drums causes the grab bar to pull along the one or more portions of the plant stalk at the end, peeling the stalk.

ABSTRACT

Methods and systems for decorticating fibrous plant stalks are disclosed. One such system includes a pair of rotatable drums. Each drum is coupled to a frame and positioned to form a gap between the drums for receiving a stalk for peeling. A pinch anvil is coupled to each drum for pinching the plant stalk adjacent an end of the plant stalk. Pinching the plant stalk severs an inner core of the plant stalk while leaving an outer bast intact and splays portions of the plant stalk at the end. A grab bar is coupled to each drum for holding one or more of the splayed portions of the plant stalk. Rotation of the drums causes the grab bar to pull along the one or more portions of the plant stalk at the end, peeling the stalk.

RIBBON DECORTICATION APPARATUS AND METHOD FOR PROCESSING GREEN FIBROUS PLANT STALKS

TECHNICAL FIELD

[0001] The present disclosure relates to ribbon decortication of plant stalks. More particularly, the present disclosure is directed to apparatus and methods for decorticating a bast fiber crop.

BACKGROUND

[0002] Mechanical ribbon decortication of hemp and kenaf is a relatively new process that has for millennia been traditionally done by hand. Most countries can't afford to produce ribbon hemp fibre due to the labour intensive nature of peeling each stalk and therefore it is currently very expensive to buy hemp ribbon.

[0003] Hemp ribbon free of any hurd contaminants is useful to composite and textile manufacturers due to its many faceted features. These features include being lighter than glass fibres but having a high tensile strength, being more durable than cotton while being four times more absorbent.

[0004] Fibrous plant crops such as hemp and kenaf contain an inner cellulose core referred to as a hurd, surrounded by an outer fibrous layer called the bast. One bast crop in particular provides three potential revenue sources being seed, technical fibre and woody cellulose which is hemp. Today industrial hemp is widely accepted as an ordinary crop again that has the potential to combat climate change in a meaningful way. Materials made from hemp fibre have been showcased by fashion designers. The transportation industry has been producing body parts on a large scale using hemp and kenaf due to their relative lightness compared to carbon and glass fibres. This in turn makes vehicles more fuel efficient while storing atmospheric carbon during the plant's lifecycle which also benefits our planet. The inner hurd, when freed of its bast is a useful biomass source suitable for use in gasification to produce liquid fuels and holds a similar calorific value to that of softwood lumber.

[0005] In addition the inner hurd can be used as a certifiable concrete block substitute called hempcrete that has an exceptional thermal coefficient. Another use is its ability to be made into paper with only hydrogen peroxide or to be turned into dust and used in bio-plastics due to its high cellulose content. Bast crops are widely considered a renewable carbon sequestering resource, in the case of hemp maturing in 100 days absorbing upwards of 30 tonnes of CO₂ per hectare.

[0006] The stalk of a hemp plant is generally of substantially circular cross-section, having a fibrous outer layer or bast and an inner core or hurd.

[0007] The outer fibre of bast plants are the more valuable commodity, although the hurd has many uses as a feedstock to other processes. It is therefore desirable to separate the fibre from the hurd to yield two distinct value-added commodities.

[0008] One principal difficulty in processing hemp has been found to lie in separating the fibre from the hurd. This process is referred to herein as decortication.

[0009] A number of proposals have been suggested for separating the fibre from the hurd. The principal category of decortication is mechanical separation. Of the mechanical operations, traditionally scutching has been the most widely used. Scutching involves manually beating the hemp stalk until the hurd is dislodged from the fibre. The beating loosens the bonds between the bast and the hurd. Current large-scale operations require multiple passes to obtain textile-quality fibre. Other known decortication methods include the use of ultrasonic sound waves to generate vibrations to break the bonds between fibre and hurd without cross-contamination.

[0010] There have been several attempts to develop a method for decortication by processing freshly cut hemp or green stalks;

[0011] GB 1,235,387 discloses the decorticating of green hemp where each plant stalk is passed through rollers, the stalk is split and beaten before the hurd is removed while the stalk is passed between two conveyors.

[0012] GB 2,205,865 discloses treating plant stalks as soon as they are cut, however, the hurd is removed from the stalk by crushing the stalks between cylinders.

[0013] WO 97/45573 describes a method and apparatus for decorticating the green plant stalk of a bast crop. To encourage the separation of the hurd from the bast, the bonds between the fibre and the hurd are ruptured. The stalk is then subsequently split and the exposed hurd is stripped from the bast by the abrasion of a toothed roller on the hurd. Bond rupturing is effected by passing the green stalks between a complex series of counter-rotating pressing rollers, before the stalk is split and stripped of the hurd. This proposal is somewhat complex and requires significant power to drive the rollers.

[0014] WO 00/20667 discloses splitting the stalk longitudinally with a stationary anvil splitter to expose the hurd. The split portion then passes through a nip of externally-fluted conditioner rollers and smooth-surfaced anvil rollers to divide the exposed hurd into segments and the fibre is separated from the hurd. This process is somewhat complex, requires significant power and leaves the fibre with hurd particles still attached unless further processing is done.

SUMMARY

[0015] In accordance with an illustrative embodiment of the disclosure, there is provided an apparatus for peeling a plant stalk. The apparatus includes a pair of rotatable drums. Each drum is coupled to a frame and positioned to form a gap between the drums for receiving a stalk for peeling. The apparatus also includes a pair of pinch anvils. Each pinch anvil is coupled to a respective drum of the pair of drums, for pinching the plant stalk adjacent an end of the plant stalk. Pinching the plant stalk severs an inner core of the plant stalk while leaving an outer bast intact and causes portions of the plant stalk at the end to move apart. The apparatus also includes a grab bar coupled to each of the drums for holding one or more portions of the plant stalk at the end. Rotation of the drums causes the grab bar to pull along the one or more portions of the plant stalk at the end, peeling the stalk.

[0016] The apparatus may also include a knife coupled to at least one of the drums for cutting the outer bast after the outer bast has been peeled off. The knife is positioned to cut the outer bast at a position adjacent one or more portions of the plant stalk at the end.

[0017] The apparatus may also include guide rails coupled to the frame and positioned for guiding a peeled stalk away from the apparatus as the peeled stalk exits the gap between the drums.

[0018] Each drum may have a circumference measuring at least as long as a length of a plant stalk being peeled.

[0019] Each pinch anvil may have a pinching portion formed by two side walls meeting at a right angle.

[0020] Each pinch anvil may have a pinching portion formed by two side walls meeting at an angle smaller than a right angle.

[0021] A rotating hub may be rotationally coupled to each drum and the pinch anvil corresponding to each drum may be coupled to the respective rotating hub.

[0022] The grab bar may be spring loaded and may be moveable in an orbit around a stationary cam. The stationary cam may be positioned inside the drum that the grab bar is coupled to.

[0023] The grab bar may be hydraulically operable.

[0024] The rotation of the drums may cause the grab bar to move to the pinch anvil coupled to the same drum as the grab bar for holding against the pinch anvil the one or more portions of the plant stalk at the end when the pinch anvils pinch the plant stalk.

[0025] Each grab bar may have a hollowed portion for accommodating one half of a thickness of a stem while holding the one or more portions of the plant stalk at the end against the pinch anvil coupled to the same drum as the grab bar.

[0026] The rotation of the drums may cause the grab bar to move away from its respective pinch anvil after the outer bast has been cut by the knife.

[0027] The guide rails may include a pair of spaced apart guide plates for directing the peeled stalk out linearly as the outer bast is wound around at least one of the drums.

[0028] The guide rails may a pair of spaced apart guide plates. Each of the spaced apart guide plates may be coupled to a miniature roller for directing the peeled stalk out.

[0029] The apparatus may also include a rubber edge mounted to each of the guide plates for sealing the peeled fibre.

[0030] The guide plates may include rounded edges.

[0031] The knives may be spring loaded and moveable in an orbit around a stationary cam. The stationary cam may be positioned inside the drum that the knife is coupled to.

[0032] The knives may be hydraulically operable.

[0033] The apparatus may also include a stationary knife coupled to the frame adjacent a path of the at least one knife for simulating a scissor action with the at least one knife as the at least one knife passes the stationary knife.

[0034] The knife may be raiseable to meet the stationary knife for creating a scissor action when the knife passes the stationary knife.

[0035] The stationary knife may have an adjustable position.

[0036] The apparatus may also include a stationary knife assembly coupled to the frame. Side edges of the stationary knife are slidably coupled to guides of the stationary knife assembly and a central portion of the stationary knife is coupled to a spring. A back end of the spring is mounted to the stationary knife assembly. The assembly provides a tensioned by lenient cutting edge for the knife to cut against.

[0037] In accordance with another illustrative embodiment of the disclosure, method for peeling fibrous stalks is provided. The method includes breaking an inner woody core of the stalk while keeping an outer bast fibre of the stalk intact by pinching the stalk between a pair of pinch anvils. The method also includes peeling the stalk by grabbing and holding a portion of an end of the outer bast between a grab bar and one of the pinch anvils and winding a peel of the outer bast around a rotating drum.

[0038] The method may also include cutting the portion of the end of the outer bast between a knife attached to the rotating drum and a knife attached to a frame that the rotating drum is coupled with to free the peeled outer bast fibre from the drum.

[0039] The method may also include guiding the peeled stalk away from the rotating drum using guide plates positioned downstream of the rotating drum.

[0040] The method may further include grabbing and holding a second portion of the end of the outer bast, the second portion being on an opposite side of the stalk from the portion, using a second grab bar and a corresponding pinch anvil from one of the pinch anvils and winding a second peel of the outer bast around a second rotating drum. The second rotating drum is positioned adjacent and spaced apart from the rotating drum.

[0041] This summary does not necessarily describe the entire scope of all aspects. Other aspects, features and advantages will be apparent to those of ordinary skill in the art upon review of the following description of specific embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] In the accompanying drawings, which illustrate one or more example embodiments,

[0043] FIG. 1 is a sectional side view of a decortication system;

[0044] FIG. 2 shows the system of FIG. 1 with a stalk partially passed through;

[0045] FIG. 3 is a partial sectional side view of a decortication system at a position prior to a stalk being pinched;

[0046] FIG. 4 shows the decortication system of FIG. 3 at a position where the stalk is pinched;

[0047] FIG. 5 shows the decortication system of FIG. 3 at a position where an outer fiber of the stalk is held by the system; and

[0048] FIG. 6 is a sectional side view of a decortication system with an outer fiber of a stalk wrapped partially around a drum of the decortication system.

DETAILED DESCRIPTION

[0049] The present disclosure provides a method and apparatus to decorticate a bast fibre crop to obtain looms of uncontaminated (hurd-free) long bast ribbon fibre and near chlorophyll-free hurd core. It has been observed that the strength of the bond between the fibre and hurd varies at various stages of growth of the plant. In a preferred embodiment, harvesting and decortication are commenced once the plants are fully mature yet still green and hydrated. The fibre of the stalk preferably remains sufficiently fine for textile use, that is to say, prior to pollen formation if grown for fibre only. The plant stalk may be harvested by cutting and stripping of leaves using known methods. The hemp may be harvested at 60-80 days maturity and preferably before substantial amounts of lignin form. Preferably the hemp is harvested before the outer fibre forms thicker fibre bundles. Before the adhesives between the hurd and outer fibres harden and most preferably at maturity or just prior to flowering are indicators of a particularly suitable time to harvest a large crop for use in accordance with the present disclosure.

[0050] In a preferred embodiment, dual-purpose (seed and fibre) monoecious varieties of hemp would be processed. In such varieties, substantially all of the leafy matter is consumed during combining of the seed, resulting in on average four foot leftover stalks with little to no leafy matter. Indicators of a particularly suitable time to use the present disclosure is when or just after the seed has ripened (around 100 days) to keep the fibre quality between the minority male & majority female plants consistent.

[0051] A method according to the present disclosure applied to fibre only crops may include the additional step of observing the growth pattern of the hemp plant in the field; where upon decortication of the crop may be commenced at a predetermined phase of growth of the plant to achieve the highest fibre quality.

[0052] Processing of the stalk is preferably commenced before the adhesive between the fibrous outer layer and the inner core dries and is preferable to be done immediately after harvesting of the seed.

[0053] In a preferred embodiment, harvesting and decortication are commenced when the plant is still green, also known as freshly cut or fresh green stalks. Freshly harvested hemp processed according to the present disclosure separates more easily into fibrous ribbons and hurd when compared to hemp in which glue between the fibrous layer and hurd has begun to dry. As the hemp dries, more power is required to strip the hurd from the stalk as the lignin between the fibrous outer layer and the inner hurd begins to dry. In a preferred embodiment, the stalks would be stored in a high humidity environment after cutting.

[0054] In a preferred embodiment, processing would be done on the field at a rate that the field would be processed within 3 days of being cut down.

[0055] The present disclosure involves taking a group of aligned stalks by the stem then breaking the inner woody core while keeping the outer bast fibre intact and then peeling the bast from the hurd to produce two strips of hurd-free ribbon bast fibre.

[0056] A major setback of this method is that the stems must be aligned before putting into the decorticator. This problem is solved primarily by a segmented wheel that constantly dumps the stalks onto a flat surface prior to falling into a hopper mounted above the decorticator.

[0057] The present disclosure also provides an effective method and apparatus to peel the outer bast fibre from the inner hurd that comprises of a pair of rotating drums that house four major components that operate in the following order: 1) Pinch Anvils - receive stalk, cutting through inner hurd but not the outer bast; 2) Grab Bars – force each end of the stem against the side of each Pinch Anvil; 3) Rounded Guides – provide exit for peeled inner wood core; 4) Knife – cut end of stem held by grab bar to free bast fibre from outer drum.

[0058] Referring to FIGS. 1 and 2, a hopper comprises a trap door 1 that is timed to open onto a pair of rollers 2 that flatten the stalks and are guided by guide 23. The rollers may be, for example, steel rollers capable of providing a range of 5-20,000 pounds of force to flatten the stalks. In some embodiments, the stalks may be flattened into a uniform thickness. The stalks may be moved a pre-determined distance by the rollers. As shown in FIG. 3, the stalks are guided so as to arrive at a point between the pinch anvils 3. In some embodiments, guide plates may be used to direct the stalk to the pinch anvils.

[0059] Still referring to FIGS. 1 and 2, the decorticator is comprised of two identical drums 25 that support the fibre as the drums turn. The drums include three major components, namely: the pinch anvils 3, the grab bars 4 and a moving knife 5. The latter two operate off of cams 16 & 20 respectively, keyed identically to a stationary shaft 14 mounted in the centre of each drum 25. In some embodiments, each grab bar is spring loaded and each one orbits a stationary cam inside a drum. In other embodiments, the grab bars may be hydraulically operated. Similarly, in some embodiments, a knife is spring loaded and orbits a stationary cam inside a drum. In other embodiments, a moving knife is hydraulically operated.

[0060] Both drums are capable of withstanding the force required to overcome a row of stalks 24 and bring the pinch anvils 3 together with a gap double the thickness of the stalk's outer bast fibre.

[0061] Each drum includes a stationary shaft 14 that is securely locked into an appropriate position. The drums 25 rotate around each shaft by means of pilot bearings (not shown) and a hub 13 that can handle the force required when the pinch anvils 3 come together with stalks between them. In some embodiments, each pinch anvil may be mounted to a rotating hub, such as the hub 13 shown in FIG. 3. In other embodiments, each pinch anvil may form part of a rotating hub.

[0062] Referring again to FIG. 3, the hub 13 also serves to support the grab bar arm 8, pivot shaft 12 and knife spring holder 18. The drums turn together by way of a gear 21 that is powered by an external power source.

[0063] Referring again to FIG. 1, in some embodiments, the rollers may rotate at the same speed as the drums 25. In other embodiments, the rollers 2 may rotate at a higher or a slower speed than the drums 25.

[0064] At precisely the moment the rollers 2 bring the aligned stalks to the point marked on FIG. 3, the pinch anvils 3 come together and the grab bars 4 spring shut by way of the cam 16, a cam follower 15, and a spring 11 tensioning the pivoting arm 8 by way of an inner arm 27 (only partially shown) which extends to a bolt 28, providing a means to increase tension of the grab bar 4 by way of a spring 17. Referring to FIG. 4, as the pinch anvils 3 move towards each

other, they may pinch the stalk and cause the outer fiber of the stalk 24 to separate. As the grab bars 4 close by means of their cam position, they press each half of the stalk splayed by the pinch anvil against its corresponding pinch anvil 3, as shown in FIG. 5. In some embodiments, the grab bars come together to form a point between pinch anvils when the pinch anvils pinch the stalk. In certain embodiments, the grab bars are hollowed out behind their point to allow space for one-half of a stem to be held without compressing the stem. The grab bars may be formed of a suitable material, such as steel or heat-treated steel.

[0065] In some embodiments, each pinch anvil may form a right angled shape. The corners of the right angles of the two pinch anvils may pinch the stem to sever the inner hurd from the plant stem while leaving the outer bast fibre intact. In other embodiments, the shape of each pinch anvil may be such that the pinching corner forms an angle less than 90°, as shown in FIG. 3. These pinch anvils may also pinch the stalk without severing the outer bast fibre of the stalk. The pinch anvils may be formed of a suitable material such as steel or heat-treated steel.

[0066] With each half of the stalk secured to each drum body, the outer fiber moves to a tangent relative to the stalk end which is still being pushed through by the rollers. As the peeled stalk passes by a rounded edge that forms to a deflector plate 6, the outer bast pulls away from the stem at the break point made in the woody core by the pinch anvils 3. In some embodiments, the deflector plates are guide plates with rounded edges, with the rounded edge being at one end of each guide plate, as shown in FIG. 6 for the deflector plates 6. The guide plates with rounded edges act to facilitate and maintain peeling of the outer fibre from its inner hurd core. In some embodiments, the guide plates are located close to the arc of the grab bars, as shown in the embodiment of FIG. 3 for the deflector plates 6 and the grab bars 4. In certain embodiments, the guide plates are spaced apart enough to allow the peeled stalks to exit the decorticator cleanly, as shown in FIG. 2, where the stalk 24 is shown exiting without being squeezed between the deflector plates 6 or making contact with the deflector plates 6.

[0067] Deflector plates 6 mounted behind the drums guide the peeled inner core through the rear of the decorticator, while the outer fibre is pulled over the drum's outer skin 22. In some embodiments, two guide plates direct the peeled stalk out linearly as the outer bast fibre is wound around said drums. In other embodiments, a miniature roller is associated with each of

two guide plates mounted to a stationary part of the overall assembly. A peeled stalk between the pair of guide plates is directed out linearly by the pair of guide plates and miniature rollers as the outer bast fibre is wound around the drums. In certain embodiments, a peeled stalk is directed by a pair of guide plates linearly out into a chipper.

[0068] The guide plates may be made of a suitable materials, such as, for example, steel, aluminum, or plastic.

[0069] In some embodiments, the guide plates are mounted with a rubber edge to seal the peeled fibre.

[0070] Referring to FIG. 6, the moving knife 5 is shown mounted to an arm 9 that supports a cam follower 19 that rides a cam 20. A spring 10 is under tension as the knife blade is raised above the height of the pinch anvils 3 prior to making contact with the stationary knife assembly 7 that is kept tensioned by spring 26. The stationary knife 7 is on an angle relative to the moving knife, creating a scissor cutting motion and held in a channel with tension applied to it by spring 26. The raised knife passing the angled stationary knife blade simulates a scissor action. This action cuts off the bast/hurd portion and frees the outer bast from the drum, free of inner hurd core. In some embodiments, a moving knife raises up directly behind the pinch anvils to cut off the stem portion from the bast ribbon fibre. In certain embodiments, the grab bars 4 open, moving away from the pinch anvils, after the bast ribbon fibre has been cut off by the knife. Movement of the knife relative to the pinch anvils may be controlled by the cam 20. Movement of the grab bars relative to the pinch anvils may be by way of the cam 16.

[0071] In some embodiments, the stationary knife is adjustable to provide the best possible cut against the raised knife. In certain embodiments, a knife portion of a stationary knife assembly floats inside guides on either end while a centrally mounted spring provides a tensioned but lenient edge to the raised knife.

[0072] The knives are made of suitable materials, such as, for example, steel or heat-treated steel.

[0073] A process for peeling a fibrous plant stalk over two drums includes several steps. First, a stalk is flattened to a uniform thickness. In some embodiments, the stalk may be flattened by passing it between a pair of rollers. Next, the plant stalk is pinched to sever the inner core of the plant stalk while leaving the outer bast intact. This may be done using, for example, a pair of pinch anvils that move towards each other, pinching the stalk between them. Next, each half of the stem is grabbed and held. For example, referring to FIGS. 4 and 5, the pinched stalk splits into halves and each half is grabbed. The inner core is severed by the pinching action and the severed end is held between one of the pinching anvils 3 and a grab arm 4. Next, the peeled stalk is guided out linearly from between the drums while the outer bast fibre is wound around the drums. In some embodiments, the stalk is peeled as the grabbed and held ends of the stem are guided around the rotating drums. The inner core was severed by the pinching action in a previous step while the outer bast remained intact. As a severed end of the inner core and an end of the outer bast that is held against the pinch anvil are carried around each drum, the outer bast from the stalk is pulled away from the stalk and along behind the held end of the outer bast, as shown in FIGS. 3-6. The portion of the stalk being held (for example, the severed inner core and the end of the outer bast) is then cut to free the outer bast fibre from the drums. In some embodiments, a moving knife within each drum then raises just before it makes contact with a stationary knife by means of a stationary cam. With the fibre now free of the drum, the moving knife retracts at which point each grab bar opens to free the held portions of the stalk.

[0074] The last step of the process, which is already in widespread use in jute and sisal processing is to funnel the peeled fiber using negative air pressure onto a slowly turning loom. The loom would be an efficient means to collect and prepare the fibre for further processing into higher value goods. The inner core, now peeled of its outer skin would be chipped then dried to be utilized in a multitude of potential green sustainable products.

[0075] This summary does not necessarily describe all features of the invention. Other aspects, features and advantages of the invention will be apparent to those of ordinary skill in the art upon review of the present description of specific embodiments of the invention.

[0076] The present invention has been described with regard to preferred embodiments. However, it will be obvious to persons skilled in the art that a number of the variations and modifications can be made without departing from the scope of the invention described herein. Examples of such modifications include the substitution of known equivalents for any aspect of the invention in order to achieve the same result in substantially the same way. It is contemplated that any embodiment discussed in this specification can be implemented or combined with respect to any other embodiment, method, composition or aspect of the invention, and vice versa.

CLAIMS

1. An apparatus for peeling a plant stalk, the apparatus comprising:
 - (a) a pair of rotatable drums, each drum coupled to a frame and positioned to form a gap between the drums for receiving a stalk for peeling;
 - (b) a pair of pinch anvils, each pinch anvil coupled to a respective drum of the pair of drums, for pinching the plant stalk adjacent to an end of the plant stalk wherein pinching the plant stalk severs an inner core of the plant stalk while leaving an outer bast intact and causes portions of the plant stalk at the end to move apart; and
 - (c) a grab bar coupled to each of the drums for holding one or more portions of the plant stalk at the end;wherein rotation of the drums causes the grab bar to pull along the one or more portions of the plant stalk at the end, peeling the stalk.
2. The apparatus of claim 1 further comprising at least one knife coupled to each of the at least one of the drums for cutting the outer bast after the outer bast has been peeled off, wherein the at least one knife is positioned to cut the outer bast at a position adjacent to the one or more portions of the plant stalk at the end.
3. The apparatus of claims 1 or 2 further comprising guide rails coupled to the frame and positioned for guiding a peeled stalk away from the apparatus as the peeled stalk exits the gap between the drums.
4. The apparatus of any one of claims 1 to 3 wherein each pinch anvil has a pinching portion formed by two side walls meeting at a right angle.

5. The apparatus of any one of claims 1 to 3 wherein each pinch anvil has a pinching portion formed by two side walls meeting at an angle smaller than a right angle.
6. The apparatus of any one of claims 1 to 5 wherein a rotating hub is rotationally coupled to each drum and the pinch anvil corresponding to each drum is coupled to the respective rotating hub.
7. The apparatus of any one of claims 1 to 6 wherein each grab bar is spring loaded and moveable in an orbit around a stationary cam, with the stationary cam being positioned inside the drum that the grab bar is coupled to.
8. The apparatus of any one of claims 1 to 6 wherein each grab bar is hydraulically operable.
9. The apparatus of any one of claims 1 to 8 wherein the rotation of the drums causes each grab bar to move to the pinch anvil coupled to the same drum as the respective grab bar for holding against said pinch anvil the one or more portions of the plant stalk at the end when the pinch anvils pinch the plant stalk.
10. The apparatus of any one of claims 1 to 9 wherein each grab bar has a hollowed portion for accommodating one half of a thickness of a stem while holding the one or more portions of the plant stalk at the end against the pinch anvil coupled to the same drum as the grab bar.
11. The apparatus of any one of claims 2 to 10 the rotation of the drums causes each grab bar to move away from its respective pinch anvil after the outer bast has been cut by the at least one knife.
12. The apparatus of any one of claims 3 to 11 wherein the guide rails comprise a pair of spaced apart guide plates for directing the peeled stalk out linearly as the outer bast is wound around at least one of the drums.

13. The apparatus of any one of claims 3 to 11 wherein the guide rails comprise a pair of spaced apart guide plates and wherein each of the spaced apart guide plates is coupled to a miniature roller for directing the peeled stalk out.
14. The apparatus of claim 12 wherein each of the guide plates comprises rounded edges.
15. The apparatus of any one of claims 2 to 14 wherein the at least one knife is spring loaded and moveable in an orbit around a stationary cam, with the stationary cam being positioned inside the drum that the at least one knife is coupled to.
16. The apparatus of any one of claims 2 to 14 wherein the at least one knife is hydraulically operable.
17. The apparatus of any one of claims 2 to 16 further comprising a stationary knife coupled to the frame adjacent a path of the at least one knife for simulating a scissor action with the at least one knife as the at least one knife passes the stationary knife.
18. The apparatus of claim 17 wherein the at least one knife is raiseable to meet the stationary knife for creating a scissor action when the at least one knife passes the stationary knife.
19. The apparatus of claims 17 or 18 wherein the stationary knife has an adjustable position.
20. The apparatus of any one of claims 17 to 19 further comprising a stationary knife assembly coupled to the frame, wherein side edges of the stationary knife are slidably coupled to guides of the stationary knife assembly and a central portion of the stationary knife is coupled to a spring, with a back end of the spring mounted to the stationary knife assembly, for providing a spring tensioned cutting edge for the at least one knife to cut against.
21. A method for peeling a fibrous plant stalk, the method comprising:
 - (a) flattening a plant stalk to a uniform thickness;

- (b) pinching the plant stalk adjacent to an end of the plant stalk to sever an inner core of the plant stalk while leaving an outer bast intact;
 - (c) holding an end of the outer bast;
 - (d) peeling the stalk by pulling the held end around a rotating drum while the peeled stalk is guided linearly away as a peel of the outer bast fibre is wound around the drum; and
 - (e) cutting the portion of the outer bast being held to free the peel of the outer bast fibre from the drums.
22. A method for peeling fibrous stalks, the method comprising:
- (a) breaking an inner woody core of the stalk while keeping an outer bast fibre of the stalk intact by pinching the stalk adjacent to an end of the plant stalk between a pair of pinch anvils; and
 - (b) peeling the stalk by grabbing and holding a portion of an end of the outer bast between a grab bar and one of the pinch anvils and winding a peel of the outer bast around a rotating drum.
23. The method of claim 22 further comprising cutting the portion of the end of the outer bast between a knife attached to the rotating drum and a knife attached to a frame that the rotating drum is coupled to for freeing the peeled outer bast fibre from the drum.
24. The method of claim 22 or claim 23 further comprising guiding the peeled stalk away from the rotating drum using guide plates positioned downstream of the rotating drum.
25. The method of any one of claims 22 to 24 comprising grabbing and holding a second portion of the end of the outer bast, the second portion being on an opposite side of the stalk from the portion, using a second grab bar and a corresponding pinch anvil from one of the pinch anvils and winding a second peel of the outer bast around a second rotating drum, wherein the second rotating drum is positioned adjacent to and spaced apart from the rotating drum.

