

May 21, 1968

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3,384,233

PROCESS AND APPARATUS FOR DRYCLEANING SUGARCANE

Filed Oct. 8, 1965

2 Sheets-Sheet 1

FIG. 1.

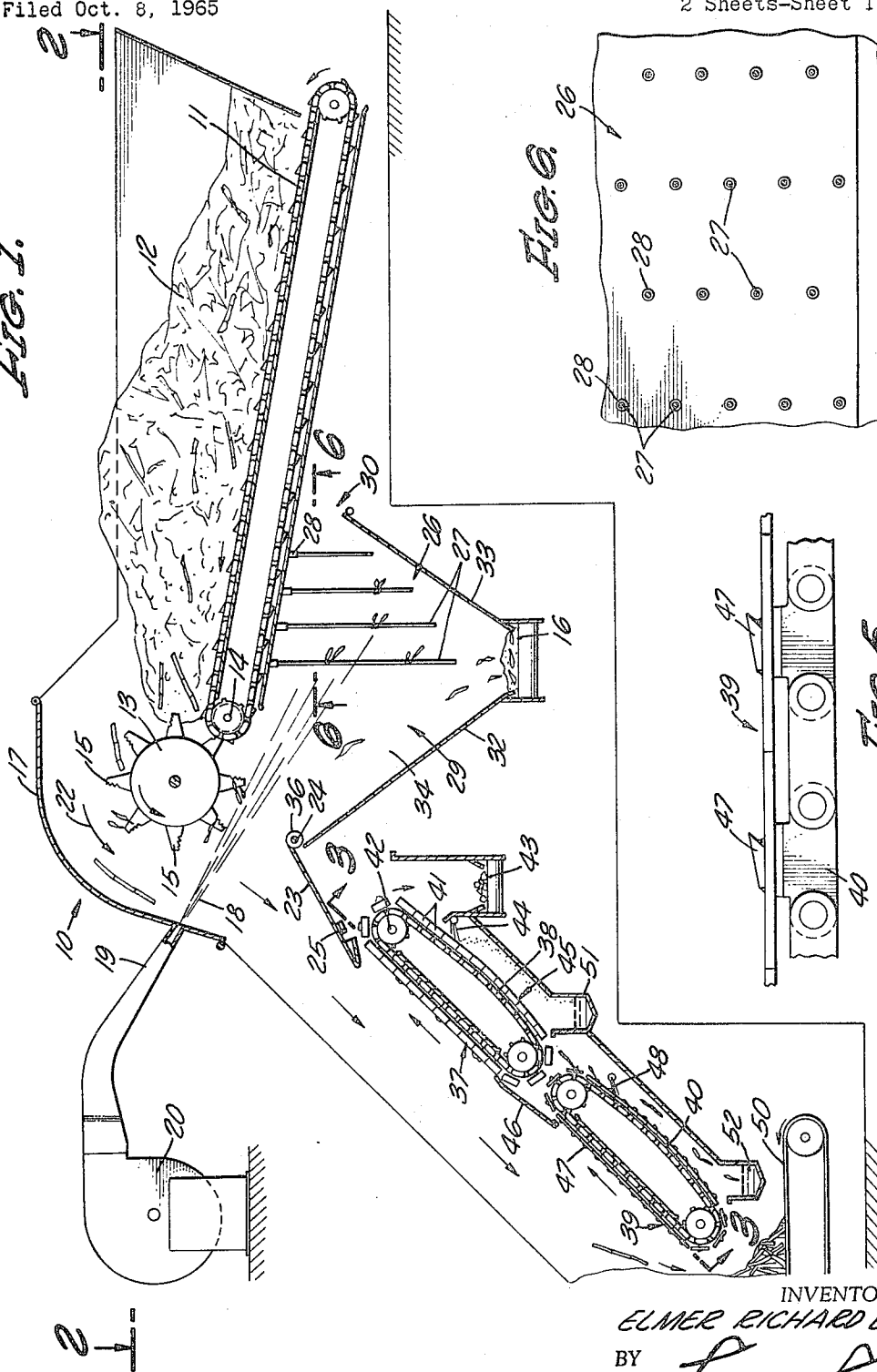


FIG. 6.

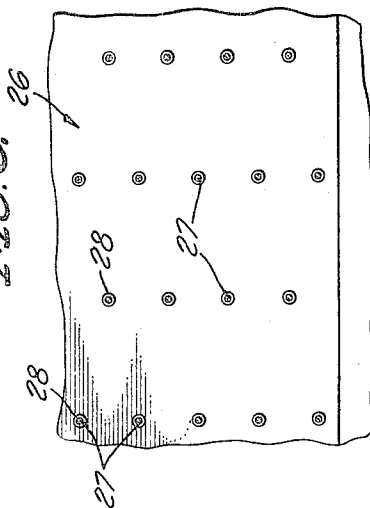
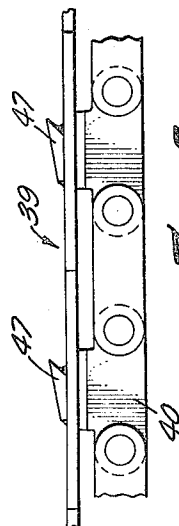


FIG. 5.



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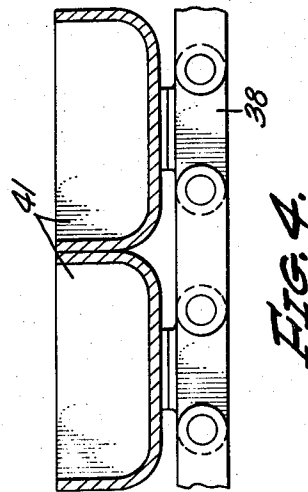
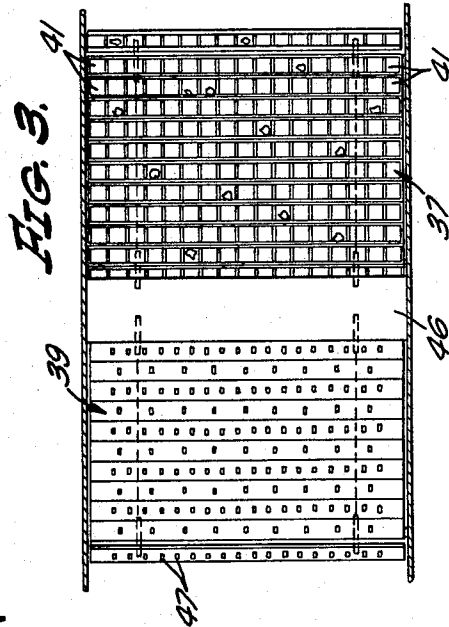
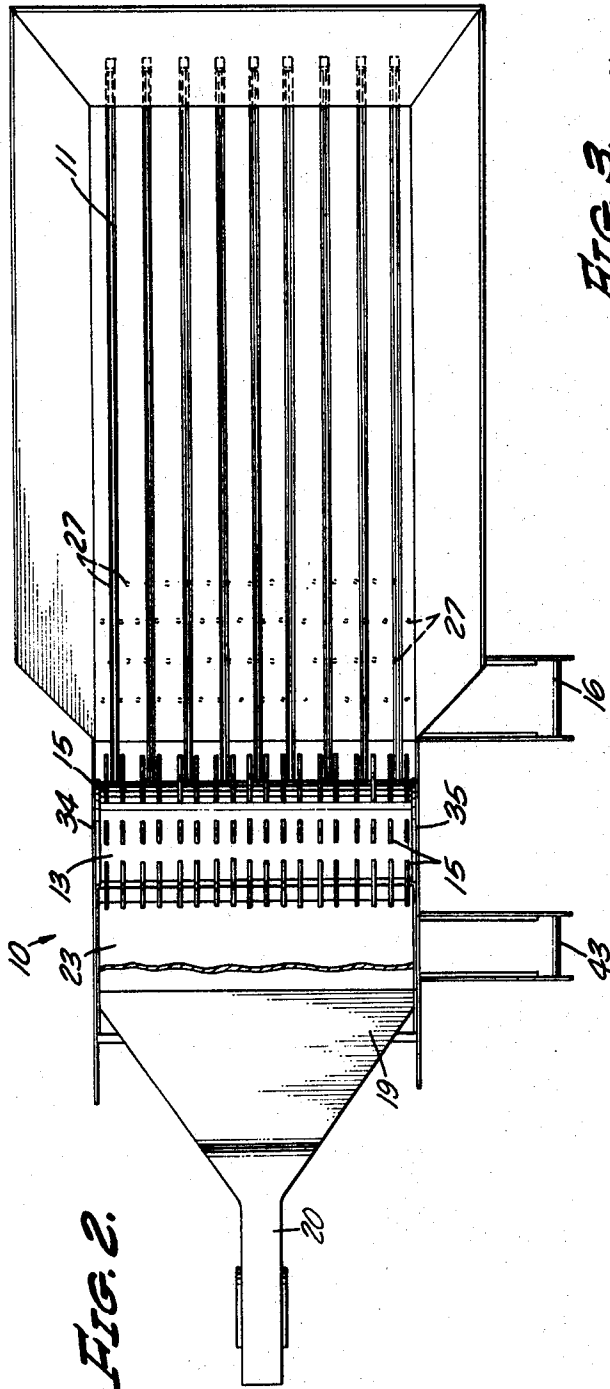
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PROCESS AND APPARATUS FOR DRYCLEANING SUGARCANE

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2 Sheets-Sheet 2



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3,384,233 PROCESS AND APPARATUS FOR DRYCLEANING SUGARCANE

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ABSTRACT OF THE DISCLOSURE

A process and apparatus for separating leafy trash and heavy trash from sugarcane stalks after harvesting includes the steps of and means for directing a jet of air laterally through a free-falling stream of intermingled cane stalks and trash to separate the leafy trash from the stream and then to remove additional trash by passing the stream downward in counter-flow relation with inclined upward moving reaches of endless conveyors, the sugarcane stalks cascading downward over the upper reaches.

This invention relates to a process and apparatus for removing leafy trash and heavy trash from sugarcane stalks after harvesting.

Where sugarcane is mechanically harvested or hand-cut and mechanically loaded, large amounts of field trash are usually intermingled with the harvested cane. This is especially true in Hawaii, where the cane yields are heavy and recumbent at harvesting time. This condition requires a type of harvesting, which by its nature, results in the entrainment of field trash with the harvested cane. This trash is of generally two types, one, leafy trash consisting of dead leaf trash and green cane tops, and two, heavy trash consisting of rocks, soil and gravel. Although it is common practice in Hawaii to burn the field prior to harvesting for the purpose of removing most of the leafy trash, in certain areas of heavy rainfall good trash burns before harvesting are difficult to achieve and the amount of leafy trash in the harvested cane is excessive.

Before the trashy sugarcane can be milled it is necessary that most of the extraneous material be removed. At the present time in Hawaii, this is accomplished by means of large and complex cane-washing plants. In this process considerable sugar is washed out of the cane and is lost in the wash water. Also, the leafy trash is saturated by the wash water, thereby making it too wet for disposal by burning. As a rule of the thumb, for each pound of leafy trash processed with the sugarcane, one pound less sugar is produced.

Another serious problem concerns the loss of top soil which is carried off by the wash water and as a rule is irrevocably lost in the canefield from which it came. Moreover, this top soil carried away by the wash water pollutes the streams and discolors and pollutes ocean water in the vicinity of the refineries.

The principal object of this invention is to provide a process and apparatus for removing both the leafy trash and heavy trash from the cane stalks in a process which is essentially dry. The trash is pneumatically and mechanically extracted without the aid of large quantities of water. Achievement of this objective results in four major advantages: (a) Important quantities of sugar are saved which are otherwise lost in the wash water of conventional sugarcane cleaners; (b) the extracted leafy trash is in a much dryer condition and is therefore easier to dispose of by burning; (c) the dry extraction of heavy trash, soil, gravel and rocks, from the sugarcane stalks, alleviates the disposal problem and minimizes the pollution of

streams and ocean areas; (d) the capital cost and maintenance costs of the cane-cleaning plant is greatly reduced.

Briefly stated, the objects of this invention are achieved in a process and apparatus in which a stream of intermingled cane stalks and leafy trash and heavy trash are delivered for free gravity fall. A jet of air is blown laterally through the free-falling stream to blow some of the leafy trash laterally from the stream, where it is intercepted by a plurality of pendantly supported upright rods. Vibration and oscillation of the rods is accomplished by the moving air and leafy trash, and the rods serve to dissipate the air jet and reduce its velocity to permit the leafy trash to descend along the rods by gravity and fall from the lower ends of the rods. The remaining portion of the free-falling mixture is intercepted by a pair of inclined conveyors positioned in series so that the mixture cascades downward over upward moving reaches of both conveyors, the first conveyor having pockets to catch heavy trash and the second conveyor having upward facing barbs to catch more of the leafy trash. In this way the conveyors carry heavy trash and leafy trash upward while the cane stalks continue to cascade downward over the conveyor surfaces. Other and more detailed objects and advantages will appear hereinafter.

In the drawings,

FIGURE 1 is a side elevation in diagrammatic form showing a preferred form of apparatus for carrying out the process of this invention.

FIGURE 2 is a plan view partly broken away taken substantially on the lines 2—2 as shown in FIGURE 1.

FIGURE 3 is a detail taken in the direction of the lines 3—3 as shown in FIGURE 1.

FIGURE 4 is a detail showing construction of the pocketed inclined conveyor.

FIGURE 5 is a detail showing construction of the barbed inclined conveyor.

FIGURE 6 is a bottom plan view taken substantially on the lines 6—6 showing the maze of pendantly supported rods.

Referring to the drawings, the cane drycleaner device generally designated 10 may be positioned at the sugarcane refinery to receive loads of harvested field cane, or it may be located in the field adjacent the harvesting operation. It has been found that for optimum drycleaner operating conditions, it is preferable to supply gross cane which has been previously cut into short lengths (from about 20 to 40 inches) either by the harvester or by an auxiliary cutting operation interposed between the harvester and the drycleaner. Also it is essential that no field rocks larger than about five inches in diameter be entrained in the mixture of harvested cane and trash.

After weighing, the gross cane is grab-loaded or dumped directly from the cane transport trucks onto the feeder conveyor 11 which operates under manual or automatic control to feed the gross cane 12 toward the revolving drum 13. The feeder conveyor 11 is a conventional multi-strand drag-chain conveyor having minimum running clearance between the conveyor head shaft 14 and the notched fingers 15 mounted on the outer surface of the drum 13. This close clearance is necessary in order to prevent loss of gross cane into the leafy trash conveyor 16. The cane is propelled centrifugally by the drum 13 against the cowl 17 where the impact tends to loosen adhering soil and gravel. The moist and pliable leafy trash is impaled on the notched drum fingers 15 which hold it against the action of centrifugal force until it reaches the underside of the drum 13.

A jet 18 of air from nozzle 19 and blower 20 passes laterally through the free-falling stream of mixed cane

stalks and trash. This high velocity air jet blows leafy trash from the free-falling mixture stream and also strips leafy trash from the notched fingers 15. The leafy trash is moved by the airstream laterally from the remainder of the mixture stream 22. Certain features of the drum 13 with its notched fingers 15 together with the air jet 18 are disclosed in my prior Patent No. 2,710,097 granted July 7, 1955.

After leaving the drum 13 the stream of mixture 22 falls by gravity through the air jet 18 onto an inclined apron plate 23 pivoted at 24 and resting against stops 25. The air blast 18 which carries leafy trash from the remainder of the stream 22 is intercepted by a maze 26 of upright rods 27 hanging from pendant supports 28. The rows of the rods are staggered and each rod is loosely suspended from its upper end and free to oscillate and vibrate in the airstream. Leafy trash in the airstream impinges on the upstream surface of these rods. As the weight of the trash builds up on these rod surfaces, the vibration of the rods set up by the stream of air causes the trash to slide downward toward the free end of the rods and out of the airstream onto the disposal conveyor 16. This maze 26 of vibrating rods 27 also serves to dissipate the kinetic energy of the airstream 18, thus lowering its velocity to a point where the heavier trash settles out of the air stream by gravity. The air escapes from the chamber 29 through the discharge opening 30. This chamber is formed by the walls 32 and 33, by the cowl 17 and by parallel side walls 34 and 35. The maze of rods, the drum 13 and a portion of the feeder conveyor 11 are also positioned in this chamber 29.

A power-driven pipe roll 36 is provided to prevent build-up of leafy trash at the upper end of the apron plate 23.

The mixture of sugarcane stalks and trash after passing through the air jet 18 cascades downward over the pivoted apron 23 and downward over the upper reaches 37 and 39 of the conveyors 38 and 40, respectively. The conveyors are inclined and are mounted in series and the upper reaches travel in an upward direction. The conveyor 38 is covered with bucket-type pockets 41 into which small rocks travel and soil can settle. This slowly moving bucket conveyor 38 carries this heavy trash under the lower end of the apron plate 23, and the inversion of the individual bucket as the conveyor goes around the head shaft 42 causes the waste material to fall to the disposal conveyor 43. The water spray 44 is directed into the open buckets 41 as they pass by on the lower reach 45 of the conveyor 38, thereby cleaning the buckets of heavy trash.

The remaining portion of the cane mixture passes from conveyor 38 over the dead plate 46 and over the upward moving reach 39 of the inclined conveyor 40. The surface of this conveyor is studded with hooks or barbs 47 which face in the direction of movement. These barbs catch or snag any loose leaf trash which has escaped extraction up to this point. The hooks or barbs 47 are small enough to offer little resistance to the cane stalks moving rapidly across the surface. The leafy trash impaled on these barbs 47 is slowly conveyed upward against the downward cane flow, under the dead plate 46 and around to the underside of the conveyor where a jet 48 of air or water is used to assist gravity in freeing the leafy trash from the barbs 47.

The clean cane stalks leaving conveyor 40 fall onto a slowly moving mill conveyor 50 which transports them to the crusher or diffuser plant. Flumes 51 and 52 may be provided for carrying away trash extracted by the conveyors 38 and 40, respectively. Removal of trash from the slack undersides of the conveyors 38 and 40 may be assisted by mechanically shaking such portions of the conveyors, if desired.

Having fully described my invention, it is to be understood that I am not to be limited to the details herein

set forth but that my invention is of the full scope of the appended claims.

I claim:

1. In a dry process for separating leafy trash from sugarcane stalks, the steps of: delivering a stream of intermingled cane stalks and leafy trash for free gravity fall, directing a jet of air laterally through the free-falling stream to blow leafy trash laterally from the stream, intercepting the air jet and leafy trash blown therewith by a plurality of upright rods, the rods serving to dissipate the air jet and reduce its velocity and thereby permit the leafy trash to descend along the rods by gravity and fall from the lower ends of the rods.

2. In a dry process for separating leafy trash from sugarcane stalks, the steps of: delivering a stream of intermingled cane stalks and leafy trash for free gravity fall, directing a jet of air laterally through the free-falling stream to blow leafy trash laterally from the stream, intercepting the air jet and leafy trash blown therewith by a plurality of pendantly supported upright rods, the rods serving to dissipate the air jet and reduce its velocity and thereby permit the leafy trash to descend along the rods by gravity and fall from the lower ends of the rods.

3. In a dry process for separating leafy trash from sugarcane stalks, the steps of: delivering a stream of intermingled cane stalks and leafy trash for free gravity fall, directing a jet of air laterally through the free-falling stream to blow leafy trash laterally from the stream, intercepting the air jet and leafy trash blown therewith by a plurality of pendantly supported upright rods, vibration and oscillation of the rods being accomplished by the moving air and leafy trash, the rods serving to dissipate the air jet and reduce its velocity and thereby permit the leafy trash to descend along the rods by gravity and fall from the lower ends of the rods.

4. In a dry process for separating both leafy trash and heavy trash from sugarcane stalks, the steps of: delivering a stream of intermingled cane stalks and leafy trash and heavy trash, cascading the stream downwardly over an upward moving inclined pocketed surface so that the latter may extract heavy trash from the cascading stream, and moving an inclined barbed surface upwardly while cascading the remaining portion of the stream downwardly thereover so that the barbed surface may extract leafy trash therefrom.

5. In a dry process for separating both leafy trash and heavy trash from sugarcane stalks, the steps of: delivering a stream of intermingled cane stalks and leafy trash and heavy trash for free gravity fall, directing a jet of air laterally through the free-falling stream to blow some of the leafy trash laterally from the stream, intercepting the laterally blown leafy trash by a plurality of pendantly supported upright rods, and cascading the remaining portion of the stream downwardly over an upward moving inclined pocketed surface so that the latter may extract heavy trash from the cascading stream.

6. In a dry process for separating both leafy trash and heavy trash from sugarcane stalks, the steps of: delivering a stream of intermingled cane stalks and leafy trash and heavy trash for free gravity fall, directing a jet of air laterally through the free-falling stream to blow some of the leafy trash laterally from the stream, intercepting the laterally blown leafy trash by a plurality of pendantly supported upright rods, cascading the remaining portion of the stream downwardly over an upward moving inclined pocketed surface so that the latter may extract heavy trash from the cascading stream, and moving an inclined barbed surface upwardly while cascading the remaining portion of the stream downwardly thereover so that the barbed surface may extract additional leafy trash.

7. In a device for separating leafy trash from sugarcane stalks, the combination of: means for delivering a mixture of cane stalks and leafy trash in a stream for free gravity fall, means including a blower for directing a jet of air laterally through the free-falling mixture to

blow leafy trash laterally, and a plurality of upright rods positioned to intercept the laterally blown leafy trash, said rods serving to dissipate the air jet and reduce its velocity and thereby permit the leafy trash to descend along said rods by gravity and fall from the lower ends of said rods.

8. In a device for separating leafy trash from sugarcane stalks, the combination of: means for delivering a mixture of cane stalks and leafy trash in a stream for free gravity fall, means including a blower for directing a jet of air laterally through the free-falling mixture to blow leafy trash laterally, a plurality of upright rods positioned to intercept the laterally blown leafy trash, and means pendantly supporting each of said rods at its upper end to permit vibration and oscillation thereof by the moving air and leafy trash, said rods serving to dissipate the air jet and reduce its velocity and thereby permit the leafy trash to descend along said rods by gravity and fall from the lower ends of said rods.

9. In a device for separating leafy trash from sugarcane stalks, the combination of: a chamber, means for delivering a mixture of cane stalks and leafy trash in a stream for free gravity fall in said chamber, means including a blower for directing a jet of air laterally through the free-falling mixture to blow leafy trash laterally, a plurality of rows of upright rods in said chamber positioned to intercept the laterally blown leafy trash, means pendantly supporting each of said rods at its upper end to permit vibration and oscillation thereof by the moving air and leafy trash, said rods serving to dissipate the air jet and reduce its velocity and thereby permit the leafy trash to descend along said rods by gravity and fall from the lower ends of said rods, and conveyor means below the rods for removing the leafy trash from the chamber.

10. In a device for separating trash from sugarcane stalks, the combination of: an endless power driven chain conveyor having an inclined upper reach movable in an upward direction, said upper reach having unobstructed space vertically thereabove for substantially its full length, said chain conveyor having links providing pockets for trash, means for delivering a stream of intermingled stalks and trash to the upper portion of the upper reach of the conveyor to cascade downward over the upward moving conveyor pockets, whereby trash enters the pockets and is carried upward while the sugarcane stalks continue to cascade downward in said unobstructed space over the upper reach of the conveyor.

11. In a device for separating both leafy trash and heavy trash from sugarcane stalks, the combination of: means for delivering a mixture of cane stalks and leafy trash and heavy trash in a stream, first and second endless conveyors having inclined upper reaches mounted in series, the inclined upper reaches each being movable in an upward direction, the free-falling mixture being intercepted by the upper reach of the first conveyor to cause

the mixture to cascade downward over the upper reaches of both conveyors, the first conveyor having pockets to catch heavy trash and the second conveyor having upward facing barbs to catch the leafy trash, whereby the conveyors carry heavy trash and leafy trash upward while the cane stalks continue to cascade downward.

12. In a device for separating both leafy trash and heavy trash from sugarcane stalks, the combination of: means for delivering a mixture of cane stalks and leafy trash and heavy trash in a stream for free gravity fall, means including a blower for directing a jet of air laterally through the free-falling mixture to blow some of the leafy trash laterally, first and second endless conveyors having inclined upper reaches mounted in series, the inclined upper reaches each being movable in an upward direction, the free-falling mixture being intercepted by the upper reach of the first conveyor to cause the mixture to cascade downward over the upper reaches of both conveyors, the first conveyor having pockets to catch heavy trash and the second conveyor having upward facing barbs to catch more of the leafy trash, whereby the conveyors carry heavy trash and leafy trash upward while the cane stalks continue to cascade downward.

13. In a device for separating both leafy trash and heavy trash from sugarcane stalks, the combination of: means for delivering a mixture of cane stalks and leafy trash and heavy trash in a stream for free gravity fall, means including a blower for directing a jet of air laterally through the free-falling mixture to blow some of the leafy trash laterally, a plurality of upright rods positioned to intercept the laterally blown leafy trash, first and second endless conveyors having inclined upper reaches mounted in series, the inclined upper reaches each being movable in an upward direction, the free-falling mixture being intercepted by the upper reach of the first conveyor to cause the mixture to cascade downward over the upper reaches of both conveyors, the first conveyor having pockets to catch heavy trash and the second conveyor having upward facing barbs to catch more of the leafy trash, whereby the conveyors carry heavy trash and leafy trash upward while the cane stalks continue to cascade downward.

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