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Titus

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[54] **DEVICE FOR THE PEELING AND EXTRACTING OF SOLID MATERIAL FROM A CENTRIFUGE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** .....**214/17 DB,** 210/374, 210/376, 233/22

[51] **Int. Cl.**.....**B65g 65/38,** B04b 11/00

[58] **Field of Search**.....214/17 D, 17 DB, 198/126, 213; 210/374, 375, 376; 233/22, 46

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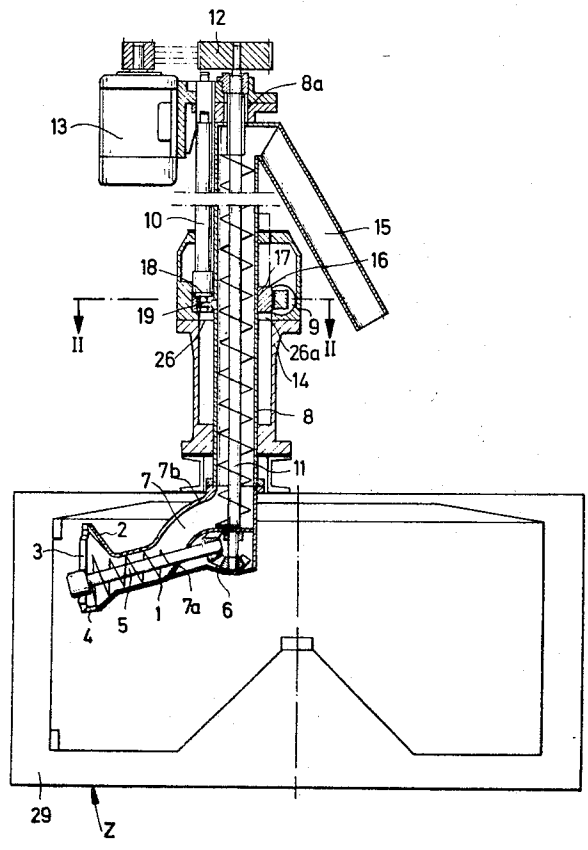
[57] **ABSTRACT**

A device for the peeling and extracting of solid material from a centrifuge, especially from a vertical centrifuge, during centrifuge operation, the device including a vertical well housing mounted on the centrifuge cover, a vertical extraction tube extending through the housing and into the centrifuge, a sideways extending pickup duct with a peeling head connected to the lower end of the extraction tube, and screw conveyors inside both the pickup duct and the extraction tube. The extraction tube is guided inside the well housing for rotational motion and for vertical motion, so that the peeling head can be approached and retracted from the centrifuge drum wall and moved vertically therealong. Hydraulic cylinders provide the rotational and vertical motions.

11 Claims, 3 Drawing Figures



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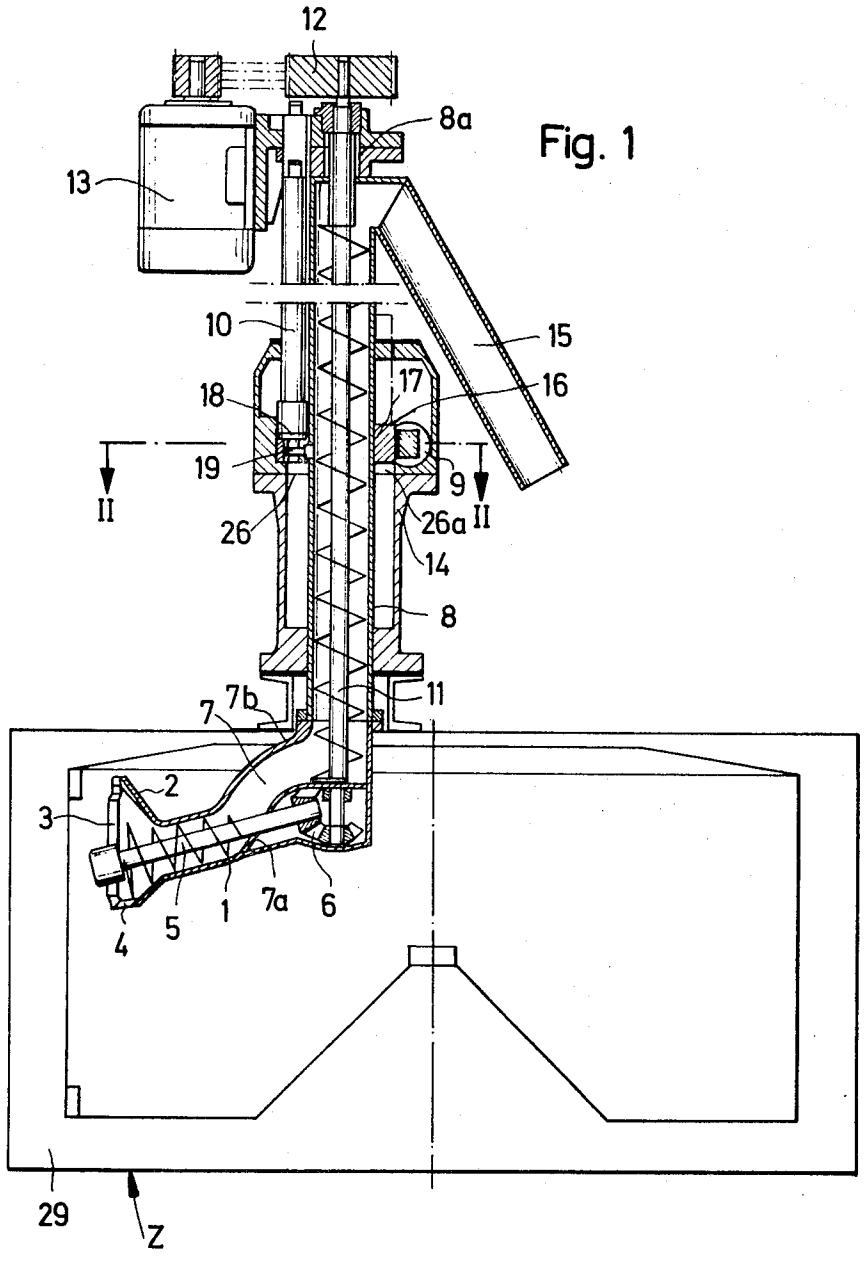

Fig. 1

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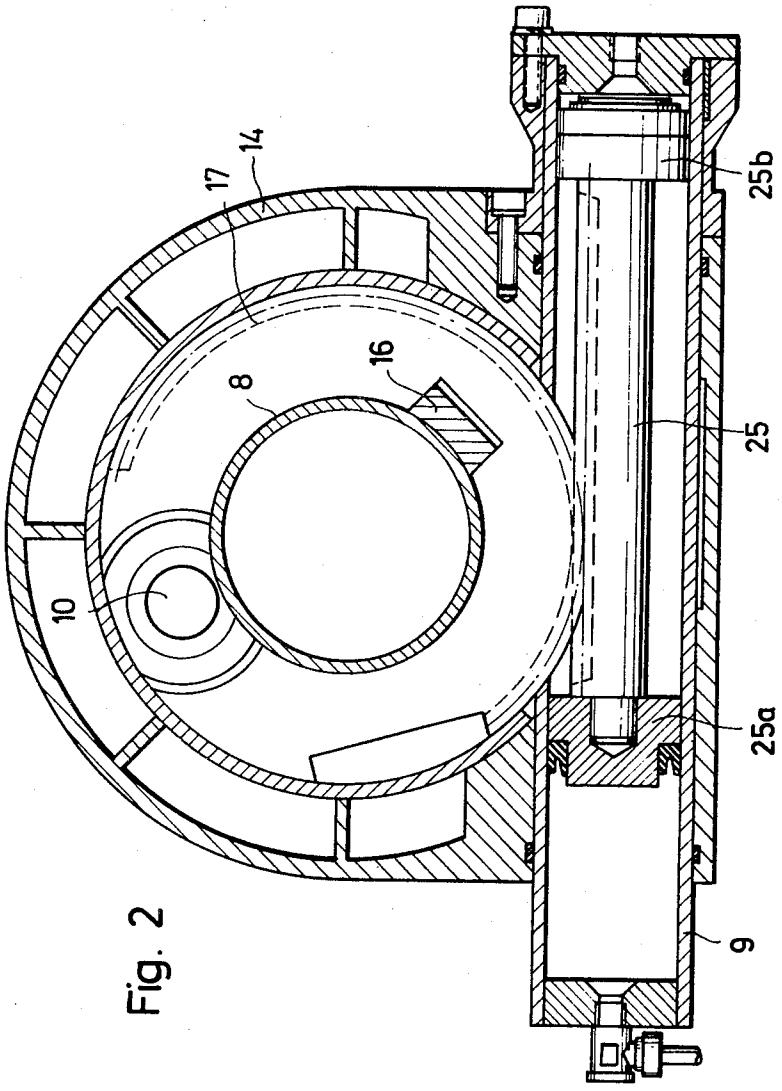

Fig. 2

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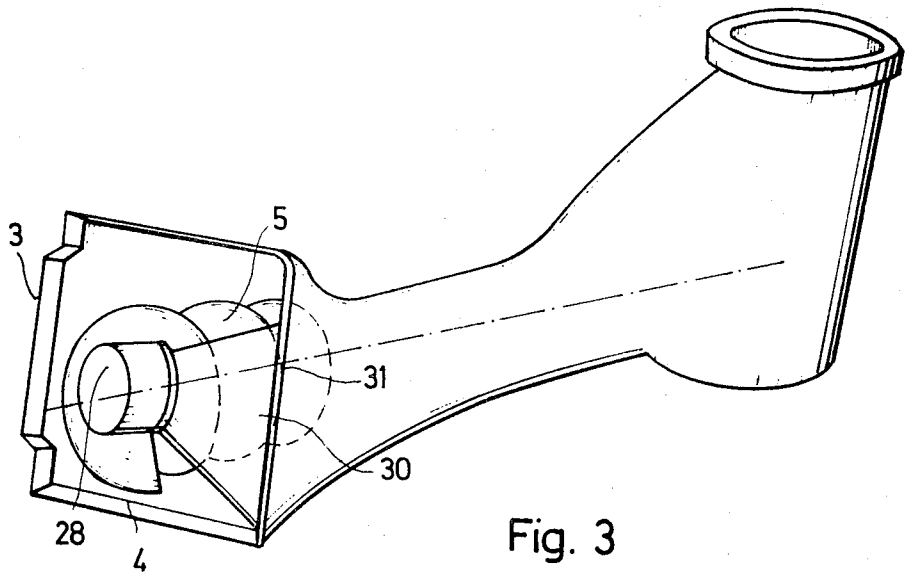

Fig. 3

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DEVICE FOR THE PEELING AND EXTRACTING OF SOLID MATERIAL FROM A CENTRIFUGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to devices for the peeling and extracting of solid material from centrifuges during operation, and in particular to such devices adapted for use with vertical centrifuges.

2. Description of the Prior Art

Of the many types of centrifuges being used in industry, the vertical centrifuge is the one most frequently found and it is used, for example, in the chemical industry as a centrifugal separator separating a suspension which was previously prepared in an agitator vessel into solid matter and liquor. However, the vertical centrifuge has an operational disadvantage in comparison with the much more expensive horizontal centrifuge, this disadvantage being the fact that the vertical centrifuge must be stopped after every centrifuging operation, and the solid matter must be shoveled out of the drum manually. As a great many products still contain solvents or acids, the personnel doing the shoveling is frequently exposed to a health hazard. In addition to this, the operation mentioned is time-consuming, troublesome, and fatiguing.

SUMMARY OF THE INVENTION

Underlying the present invention is the objective of providing a device which would eliminate the earlier-mentioned shortcomings and which would make it possible to peel the solid material from the drum wall of the centrifuge and to extract it out of the centrifuge for discharge into a storage vessel positioned near the centrifuge, all without interrupting the rotation of the centrifuge and without opening the centrifuge cover. Such a device is also especially suitable for the extraction of slimy, sticky product masses.

The above objective is attained by the present invention in that a peeling and extracting device is mounted to the centrifuge housing, the device having a rotatable and vertically movable well column whose motion is hydraulically controlled from the outside and which, at the inside of it, includes a screw conveyer. To the lower end of the well column is connected a downwardly and outwardly slanting pickup duct, likewise enclosing a screw conveyor, the pickup duct being flared at its outer end to form a rectangular peeling head with a mouth whose sides form a vertical and horizontal peeling edge. During operation, the peeling head is first moved into an end position near the drum wall by rotating the well column and pickup duct, and the head is subsequently moved vertically downward until it reaches a lower end position, by lowering the well column and pickup duct. The peeling operation being finished when the peeling head has reached the bottom of the drum, the peeling head is returned by an inverse motion sequence, being first moved upwardly along the drum wall, and then pivoted away from there toward the center of the drum. The inside end of the screw conveyor in the pickup duct is preferably rotatably coupled with the lower end of the screw conveyor in the well column by means of an equal-ration bevel gear, thereby bringing the center axes of the retraction tube and of the pickup duct to intersection, so as to represent a compact structure which can be mounted

onto existing centrifuge covers with a minimum of adaptive modification.

The diameter of the screw conveyor in the pickup duct is adapted to the flared portion at the outer end of the pickup duct, the outer end of the screw conveyor being rotatably supported inside the peeling head by a bearing bracket which is attached to the wall facing the vertical peeling edge of the mouth. For the connection between the extraction tube and the pickup duct, the pickup duct has a widened portion forming a transition casing which includes a pressure duct leading around the bevel gear, the pressure duct wall having a bore through which passes the inner end portion of the screw conveyor, thereby forming a bearing support. The solid material entering the mouth of the peeling head is seized by the outer end coils of the screw conveyor which, in this section of the pickup duct has a larger diameter; the material is then advanced into the screw portion of smaller diameter, thereby being compacted, and from here it passes into the pressure duct whose other end opens into the extraction tube where the vertical screw conveyor seized it. After termination of the extraction operation, the pressure duct will always remain filled with solid material, thus providing a gastight seal for the interior of the centrifuge against the atmosphere. This material is removed during the extraction operation on the next-following charge.

A further advantage of the invention resides in the fact that the design as suggested provides a controlled motion pattern on the peeling head so as to peel from the drum wall even the last layer adhering to it without damaging the filter cloth, while making absolutely certain that any possible damage to the drum wall or to the distributor cone on the bottom of the drum is avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

Further special feature and advantages of the invention will become apparent from the description following below, when taken together with the accompanying drawings which illustrate, by way of an example, an embodiment of the invention, represented in the various figures as follows:

FIG. 1 shows, in a schematic representation, a vertical cross-section of a peeling and extraction device embodying the invention; II—

FIG. 2 shows, at an enlarged scale, a horizontal cross-section of the device of FIG. 1 along the line II–II;

FIG. 3 shows, in a perspective view, the pickup duct and peeling head of the device shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As can be seen in FIG. 1, the device suggested by the invention is sealingly mounted on the housing cover of a centrifuge Z. The device includes a pickup duct 1 positioned inside the centrifuge, the pickup duct having at its outer end a funnel-shaped flared portion representing a peeling head with a rectangular mouth 2. Inside the pickup duct 1 is arranged a screw conveyor 5, whose diameter is likewise enlarged in the region of the peeling head. The outer end of the screw conveyor is supported by a bearing bracket 30 which is attached to the vertical wall 31 (FIG. 3) facing the vertical peeling edge 3. The inner end of the screw conveyor 5 is rotatably connected to a vertical screw con-

veyor 11 by means of a bevel gear 6 and its shaft is sealingly guided and supported in a bore in the wall 7*a*. This wall 7*a*, together with a transition casing 7*b* extending from the pickup duct 1, forms a pressure duct 7 which links the pickup duct to the vertical extraction tube 8.

The transition casing 7*b* is solidly mounted to the lower end of the extraction tube 8, and its peeling displacement is controlled by the movement of the extraction tube.

The vertical screw conveyor 11 has its lower bearing support in a bore through an extension of the pressure duct wall 7*a* and its upper bearing support in a cover 8*a* on top of the extraction tube 8, the screw conveyor 11 receiving its rotational drive via two pulleys 12 and a V-belt from an electric motor 13 which is likewise mounted on the upper end of the extraction tube 8. At its upper end, the extraction tube 8 laterally opens into a downwardly oriented discharge tube 15. For the extraction of pasty products, this discharge tube 15 may be replaced by a horizontal discharge tube with a screw conveyor in it.

The extraction tube 8 with its screw conveyor 11 and its drive 12, 13 is movable and for this purpose, it is guided and supported inside a vertical well housing 14 which in turn is mounted on the cover of the centrifuge. The well housing 14 has a radially inwardly oriented shoulder on which is rotatably supported a control collar 17. This control collar 17 has a central bore which slidably fits the outer diameter of the extraction tube 8, and on a portion of its outer periphery the collar carries gear teeth. The extraction tube 8 extending vertically through the well housing 14 is sealingly guided in the bottom end of the housing. On a portion of its length, the extraction tube carries a flat key 16 engaging, as can be seen in FIG. 2, a matching keyway in the control collar 17, thereby providing a rotational connection between the control collar 17 and the extraction tube 8, while allowing the tube 8 to move vertically relative to the collar 17.

The peripheral teeth on the control collar 17 engage a horizontal gear rack 25 which is part of the plunger of a hydraulic cylinder 9, the plunger including two piston ends 25*a* and 25*b* (FIG. 2). When the cylinder 9 is pressurized on the side of the piston end 25*b*, the plunger is moved from its first end position (shown in FIG. 2) to its second end position, thereby rotating the control collar 17 in the clockwise direction until, in the second end position, the key 16 of the extraction tube 8 is aligned with a recess 26*a* in a fixed stop 26, the stop 26 being located under the lower end of the key, when the extraction tube 8 is in its upper end position. Alignment of the key 16 with the recess 26*a* of the stop 26 allows downward advance of the extraction tube 8 and pickup duct 1.

To control the vertical displacement of the extraction tube 8 and pickup duct 1, the device includes a power cylinder 10 arranged in parallel with the extraction tube 8 and supported by the control collar 17. The latter has a recess accommodating the piston rod of the cylinder 10, the ear 18 at the end of the piston rod being attached to a pin 19 which radially extends from the extraction tube. The stop 26 has a second recess 26*b* to allow downward displacement of the ear 18 and pin 19.

The vertical power cylinder 10 remains in the same vertical position with respect to the well housing 14, but rotates together with the extraction tube 8 and drive 12, 13. To allow downward advance of the latter, the mounting structure of the motor 13 includes an opening accommodating the upper end of the power cylinder 10. A flexible rubber boot may be mounted at the upper end of the well housing 14, the boot surrounding the extraction tube and the vertical cylinder.

The control collar 17 not only transmits to the extraction tube 8 the rotary displacement motion for the pickup duct and peeling head, it also serves as a radial bearing and upper vertical guide for the extraction tube 8, while supporting the weight of the moving parts by carrying the vertical power cylinder 10.

As can be seen in FIG. 3, the pickup duct 1 is flared at its outer end to form a funnel-shaped peeling head, the head having a mouth 2 in the outline of an upended rectangle. One of the two long sides of the rectangle, the one which is trailing the other in the sense of centrifuge rotation, forms a vertical peeling edge 3, the latter having recessed portions on its upper and lower end to match the clamping rings 29 (shown in FIG. 1) which retain the filter cloth against the drum wall of the centrifuge. The peeling process is carried out along the vertical drum wall, peeling being performed by the trailing vertical peeling edge 3. During downward advance of the peeling head, additional peeling is performed by the horizontal peeling edge 4. The outer bearing 28 of the screw conveyor 5 is part of a bearing bracket 30 which is attached to the vertical wall 31 which faces the vertical peeling edge 3, and which is the leading side of the mouth in the sense of centrifuge rotation. As can be seen in FIG. 1, the mouth 2 of the peeling head is flared more above the screw conveyor than below it, so that the larger-diameter portion of the screw conveyor approaches only the lower and lateral portions of the mouth 2, the additional space above the screw conveyor being outside the reach of the screw conveyor.

A major advantage of the design as suggested by the invention, especially with respect to the guidance and support of the moving parts, is the fact that the latter are guided in clearance-free bearing supports and that their displacement is obtained with a high sensitivity and without backlash, thus making possible progressive peeling even of very thin material layers, which is necessary with certain kinds of products. The proposed design also ensures that no accidental contact occurs between the peeling head and the drum wall or the distributor cone on the bottom of the drum. The hydraulic controls also make possible an automatic operation of the device, the motion sequence being controlled by end switches (not shown in the drawings).

To reduce rotation of the solid material with the screw conveyors during conveyance, the bores surrounding the conveyors may have interrupted longitudinal grooves in their walls.

I claim:

1. A device for the peeling and extracting of solid material, particularly of a pasty or sticky consistency from a centrifuge, especially from a vertical centrifuge, during centrifuge operation, comprising in combination:

a closed well housing for mounting the device onto an apertured cover of a stationary centrifuge casing;

a vertical extraction tube extending through the well housing into the centrifuge at a location between the vertical wall and the central axis of the centrifuge, the extraction tube being sealingly guided in the well housing for vertical and rotational motion relative to the well housing and centrifuge;

means for providing vertical motion to the extraction tube relative to the well housing, thereby moving the extraction tube between two vertical end positions;

a pickup duct attached to the lower end of the extraction tube and communicating therewith, the general axis of the pickup duct forming an angle with the axis of the extraction tube, the pickup duct having a peeling head with a mouth at an end away from the extraction tube axis;

means for providing a rotational motion to the extraction tube relative to the well housing, thereby moving the peeling head between two rotational end positions, approaching and retracting it relative to the vertical wall of the centrifuge; and

mechanical conveyor means extending inside the extraction tube and the pickup duct.

2. The device as defined in claim 1, the extraction tube and pickup duct having substantially cylindrical bores;

the mechanical conveyor means being in the form of a pickup screw conveyor rotatably mounted inside the pickup duct, and an extraction screw conveyor rotatably mounted inside the extraction tube;

the conveyor means further including means to operably connect the two screw conveyors for simultaneous rotation.

3. The device as defined in claim 2, the axes of the extraction tube and the pickup duct intersecting one another at an angle of approximately 95 to 120°; the rotary connecting means between the two screw conveyors being a bevel gear.

4. The device as claimed in claim 3, the pickup duct including a transition casing in the area where it is attached to the extraction tube, the transition casing including:

a bevel gear casing sealingly separated from both the pickup duct bore and the extraction tube bore; and

a curved pressure duct linking the near ends of the pickup duct bore and extraction tube bore outside the bevel gear casing;

the bevel gear casing and the pressure duct having a common curved separating wall, the separating wall including two bores serving both as sealing shaft passages for the inner end of the pickup screw conveyor and the lower end of the extraction conveyor, and also as bearing supports therefor.

5. The device as claimed in claim 2, the peeling head of the pickup duct having its outer end portion flared to form an enlarged rectangular mouth in the form of a funnel; the pickup screw conveyor having a likewise enlarged diameter in the flared duct portion;

the mouth of the peeling head including a vertical peeling edge at its trailing side in the sense of centrifuge rotation, a lower horizontal peeling edge adjacent said vertical peeling edge, and a bearing bracket supporting the outer end of the pickup screw conveyor, the bearing bracket being attached to the leading side of the mouth.

6. The device as claimed in claim 2, the means to create a rotational motion of the extraction tube including:

a radially inwardly extending horizontal bearing shoulder as part of the well housing;

a control collar positioned above the bearing shoulder concentrically with the housing axis and rotatably supported and guided on the bearing shoulder; the extraction tube having a cylindrical outer surface, and the control collar having a central guide bore slidably fitting around the extraction tube;

a key-and-keyway rotational connection between the control collar and the extraction tube allowing relative vertical motion between the two; and

means to rotate the control collar between the two rotational end position.

7. The device as defined in claim 6, the well housing further including a fixed stop collar located underneath the control collar;

the key-and-keyway connection including: a vertical flat key attached to the extraction tube and a matching keyway in the control collar; the lower end of the key being positioned just above the stop collar, when the extraction tube is in its upper end position;

the stop collar preventing downward motion of the extraction tube by engaging the lower end of the key in all rotational positions of the extraction tube except in the approached end position of the peeling head, in which position the stop collar has a recess through which the key of the extraction tube can pass downwardly;

the rotating means for the control collar including:

gear teeth on at least a portion of the periphery of the control collar;

a horizontal gear rack in engagement with the teeth on the collar;

a power cylinder attached to the well housing and aligned with the gear rack, the gear rack being a part of the plunger of the power cylinder.

8. The device as defined in claim 6, the means to create the vertical motion of the extraction tube including:

a vertical power cylinder aligned adjacent to the extraction tube above the control collar, the lower end of cylinder being supported by the control collar and rotatably entrained therewith;

the piston rod of the vertical power cylinder being connected to the well column so as to carry its weight, when the column is lowered and raised;

a recess in the control collar in alignment with the power cylinder axis; the piston rod in the power cylinder extending downwardly;

a radially extending pin on the extraction tube, the lower end of the piston rod being engaging the pin;

the pin and the piston rod end being accommodated within the control collar recess, when the well column is in its upper end position.

9. The device as claimed in claim 1, the extraction tube including a downwardly oriented discharge tube

communicating with the upper end portion of the extraction tube.

10. The device as claimed in claim 2, the extraction tube including a radially oriented discharge tube communicating with the upper end portion of the extraction tube;

the mechanical conveyor means further including a discharge screw conveyor inside the discharge tube and means to operably connect the discharge screw conveyor with the extraction screw conveyor for simultaneous rotation.

11. The device as claimed in claim 2, the driving means for the mechanical conveyor means including an electric motor and drive transmission means connected to the upper end of the extraction conveyor, the driving means being mounted on the extraction tube for rotational and vertical movement therewith;

the bores of the extraction tube and pickup duct surrounding the respective screw conveyors including interrupted longitudinal grooves in their walls to reduce rotation of the solid material during conveyance.

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