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(54) **Fruit-shelling machine**

(57) A machine for shelling fruit comprises a drive-unit (2) which via shaft (5) is operable to rotate two pairs of rollers (10, 11 and 13, 14) between which fruit is fed from an elevator (21) driven by the unit (2) and drums (A, B) driven by the unit (2) through which drums fruit broken open by the rollers is passed in order to first separate fibrous material therefrom in drum (A), this material passing between rollers at drum periphery and then remove the seeds or grains through the perforated wall of the drum (B) and collectors (50), larger residual material passing through drum (B).

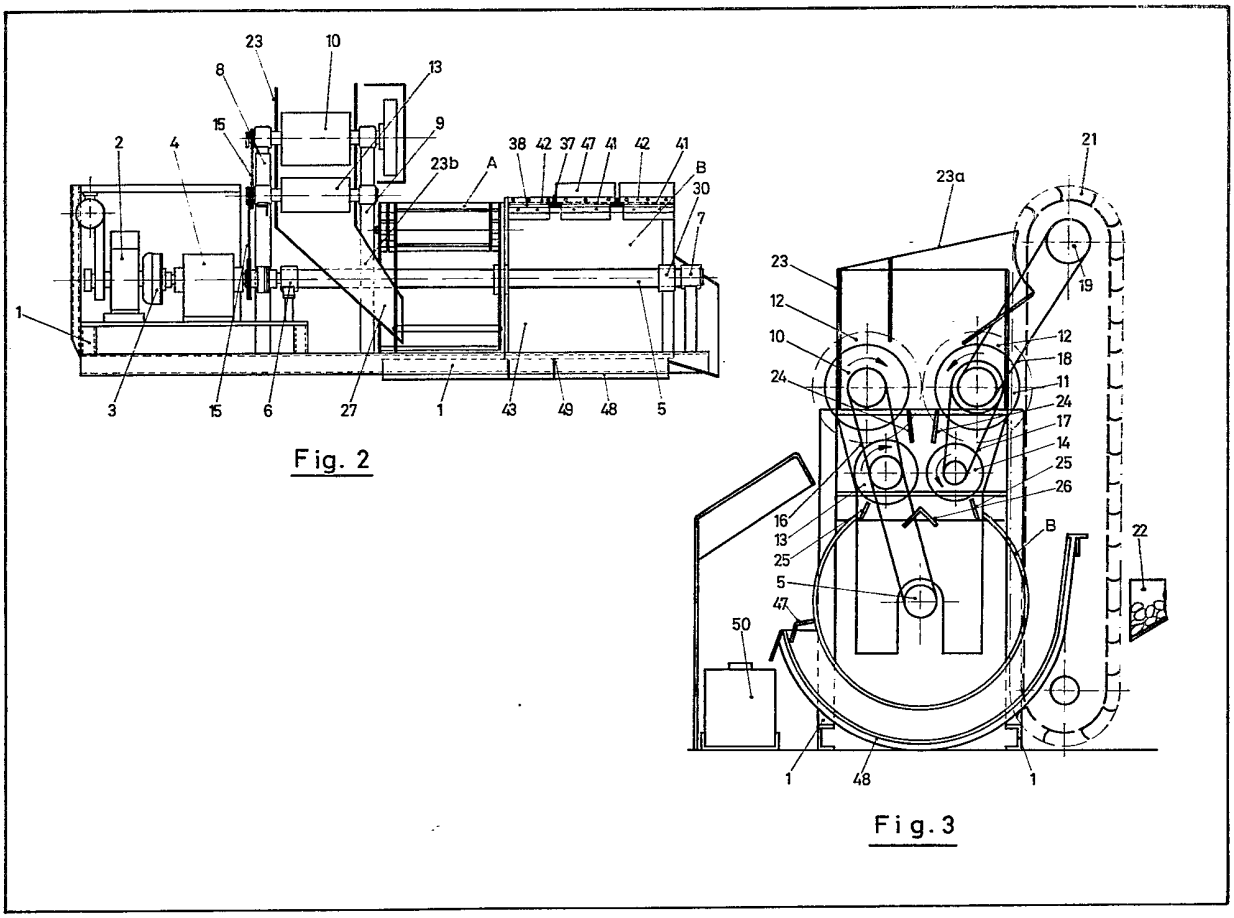


Fig. 2

Fig. 3

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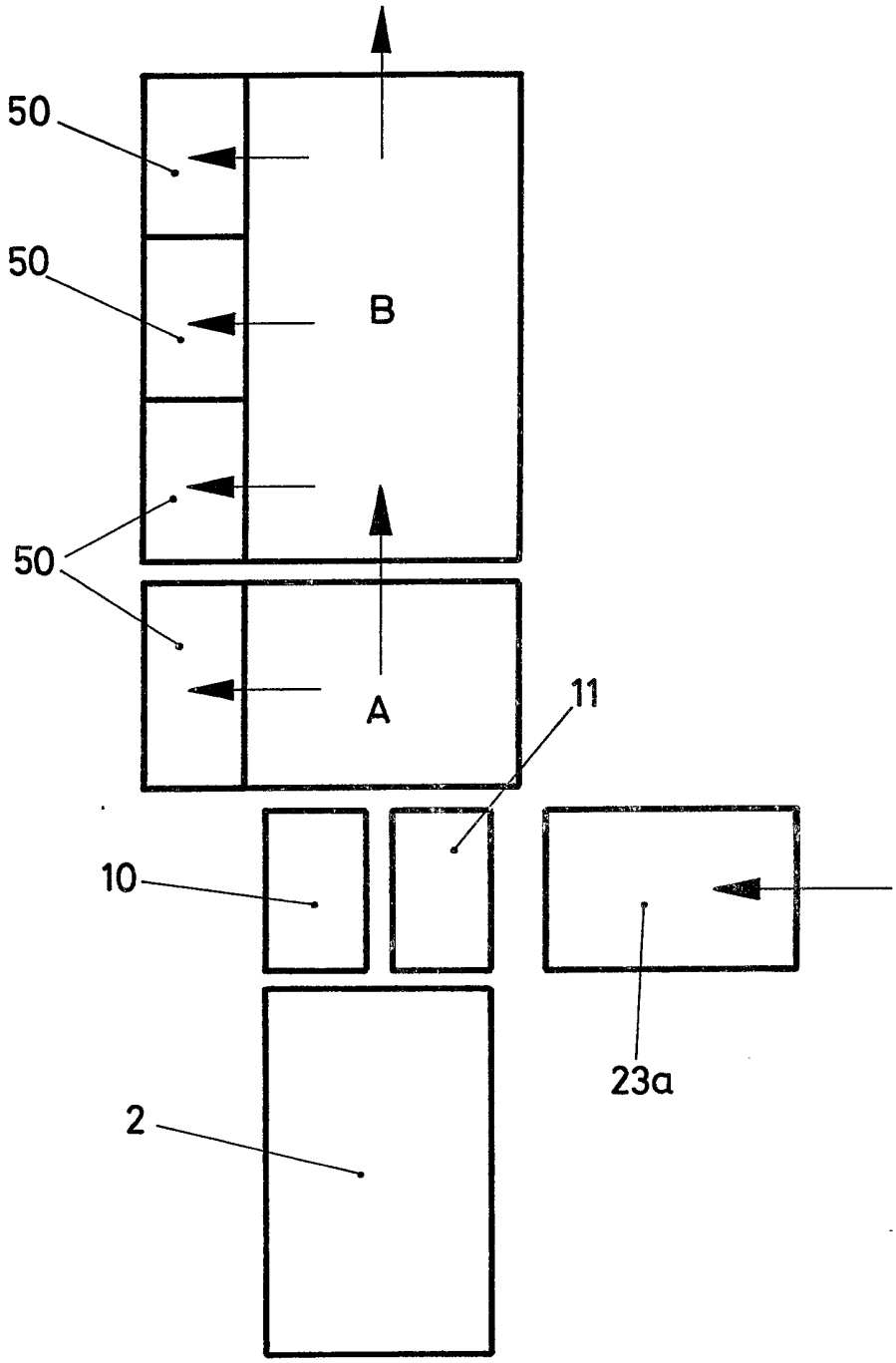


Fig. 1

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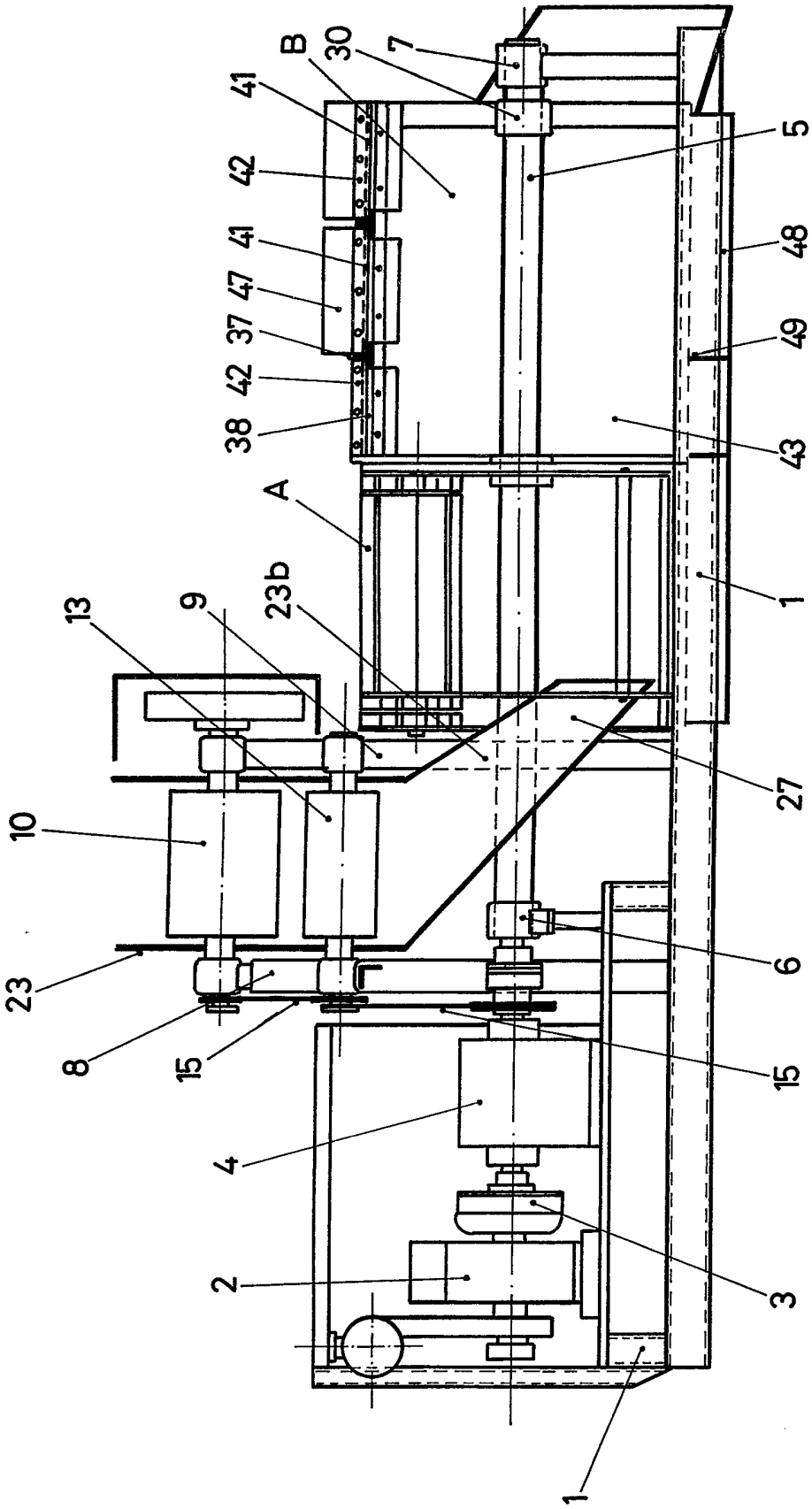


Fig. 2

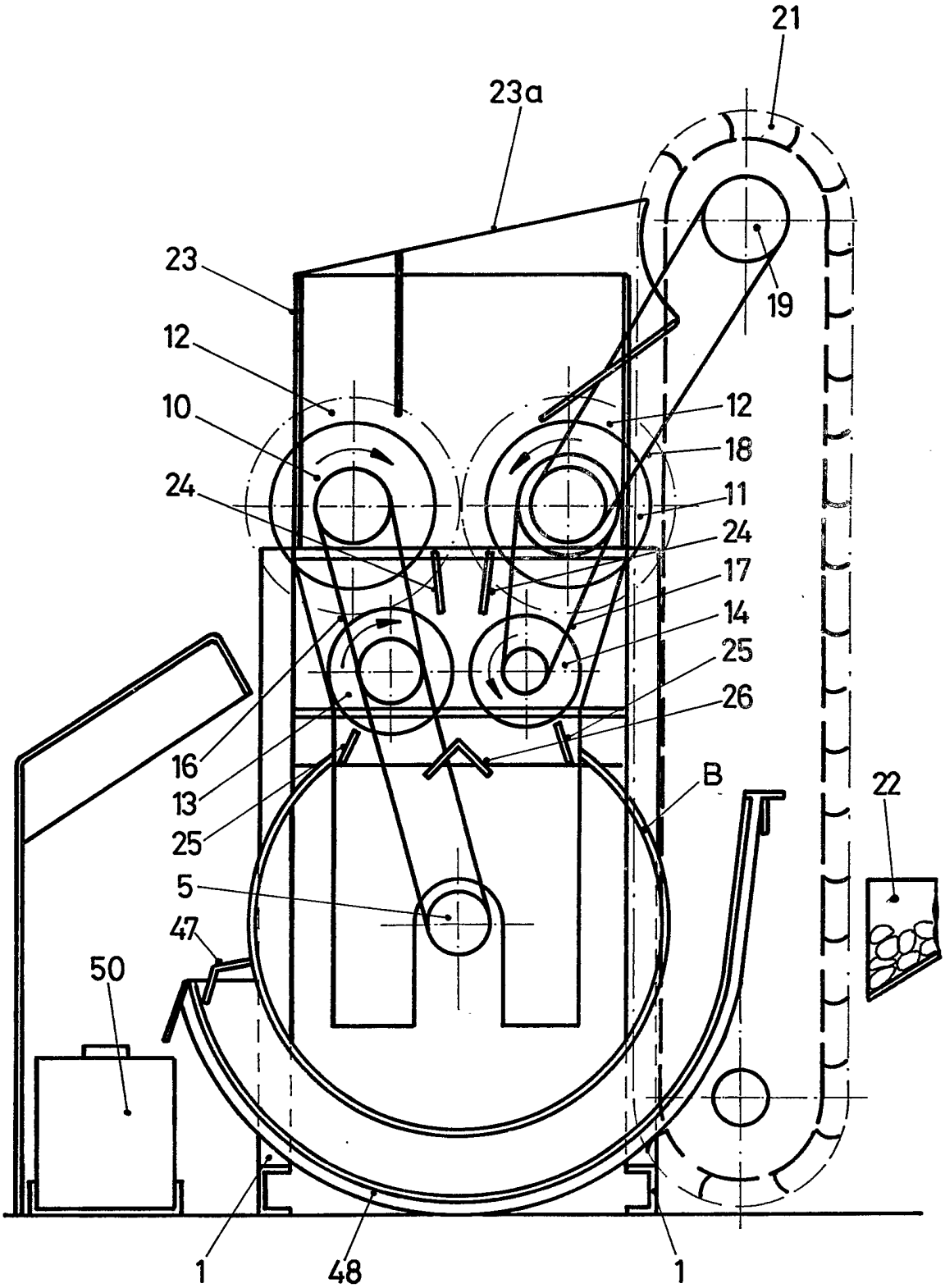


Fig. 3

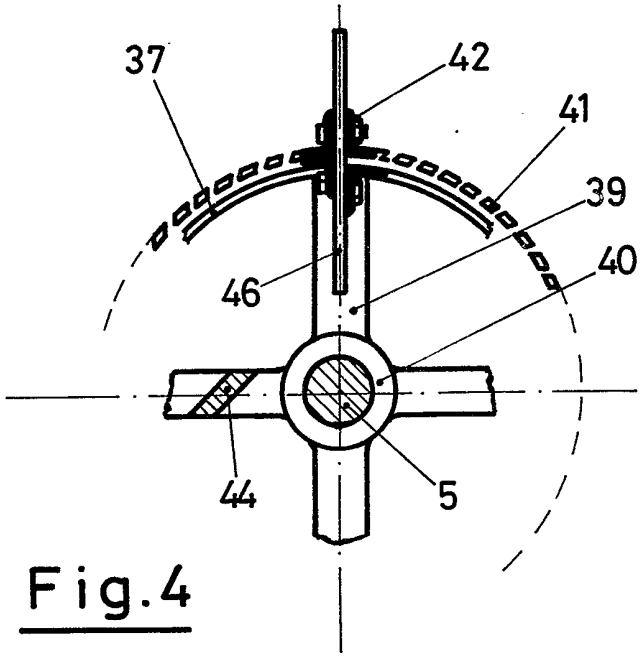


Fig.4

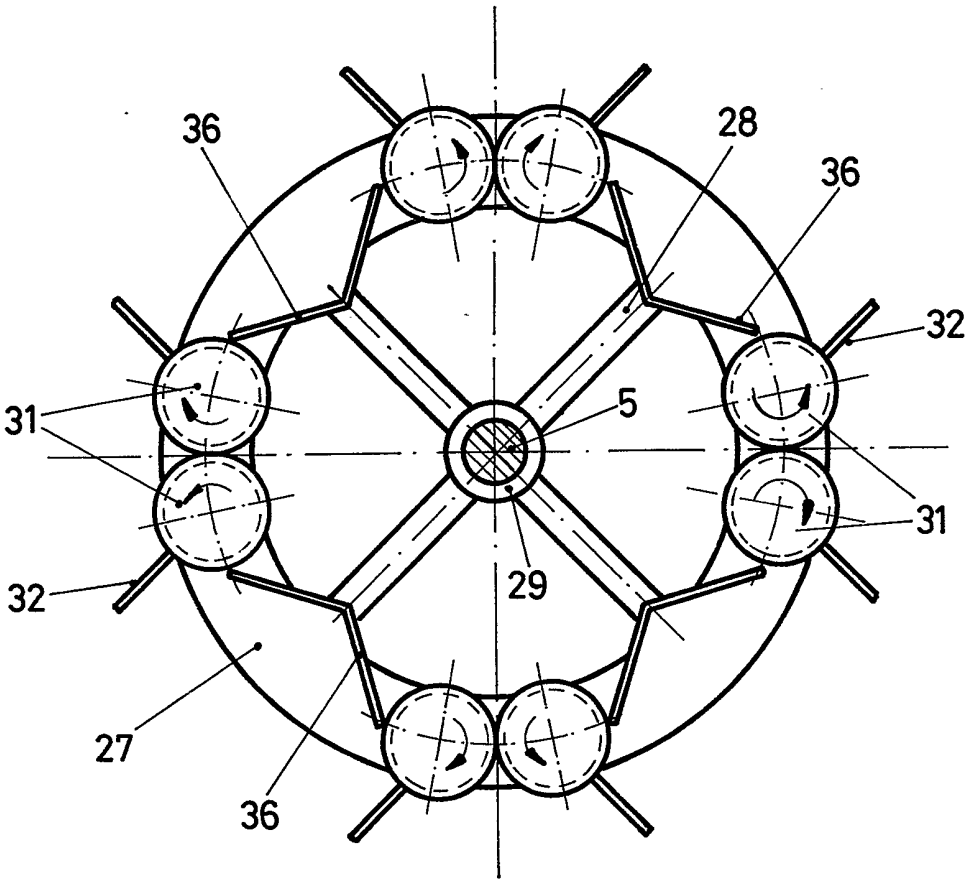


Fig.5

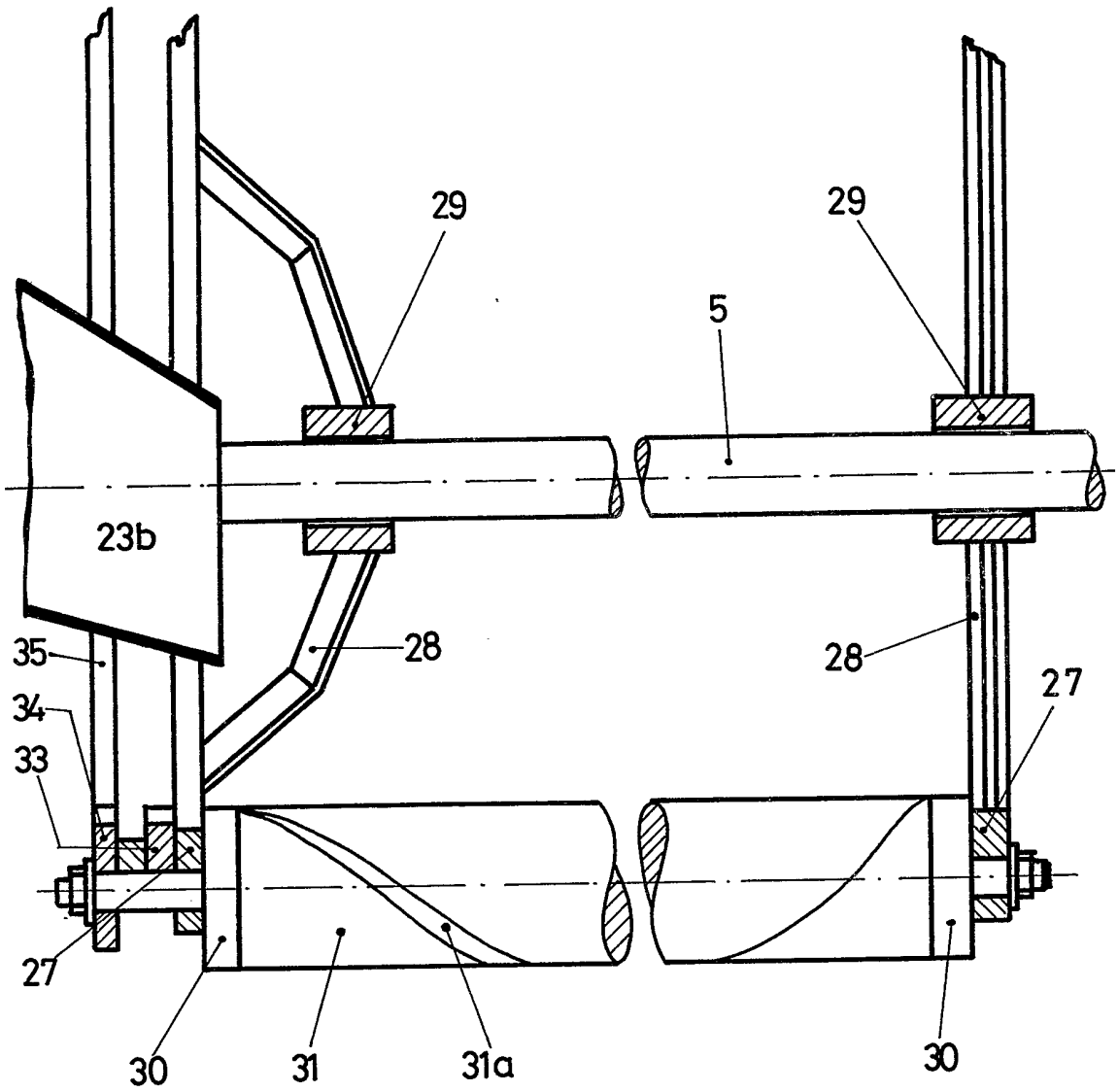


Fig. 6

SPECIFICATION

Fruit-shelling machine

Up to the present time, the breakage of the fruit or pods of the cocoa tree in order to remove and process the grains or seeds contained therein, constitutes an essentially manual task, carried out by means of blows with a cane knife or other suitable cutting element. Under such conditions the work is very painful, highly dangerous and results in a relatively low yield.

The present invention relates to a machine which is intended to overcome said disadvantages, by carrying out, at the plantation or elsewhere, in a completely satisfactory manner, the whole mechanical process necessary to break open the fruit or pods and isolate and separate the grains, with the advantage that this machine can be used not only for the treatment of cocoa tree fruit but also for any type of seed-containing fruit.

The machine of the invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 is a schematic view showing, by means of the block system, the distribution of the various parts making up the machine according to the invention;

Figure 2 shows a longitudinal sectional view of said machine;

Figure 3 is a transverse sectional view of the machine shown in Fig. 2;

Figure 4 shows a partial transverse sectional view of the screening drum which forms part of the machine according to the invention;

Figure 5 is a transverse sectional view of another drum, for the extraction of fibres, which also forms a part of the machine according to the invention; and

Figure 6 is a partial, longitudinal sectional view of the drum shown in Fig. 5.

Referring to the drawings, the machine has a supporting chassis or frame 1 designed to be either placed directly on the ground (when the machine has to be installed, for example, in an industrial building) or to be fitted with wheels for facilitating movement of the machine to the place where the fruit to be processed is harvested.

A suitable drive unit 2 is fixed to said chassis or frame 1 and provides the necessary drive for the operation of the machine, said drive unit being connected to a hydraulic coupling 3, designed to allow the drive unit to be started and left idling, and to a speed reducer 4, placed immediately after the hydraulic coupling, and from which projects a shaft 5 rotatable in response to the drive generated by the drive unit 2, said shaft extending longitudinally of the machine and resting on two bearings 6 and 7.

To said chassis or frame 1 are also fixed, in front of the speed reducer 4, two vertical and parallel supports 8 and 9, between which are mounted shafts which support for rotation the following elements:

Two similar rollers 10 and 11 arranged in the same horizontal plane and located on the upper ends of the supports 8 and 9, which rollers rotate at the same speed in opposite directions, as indicated by the arrows in Fig. 3. These rollers are provided with gears 12 which enable the rotation of one roller to be transmitted to the other, said rollers being further provided on their surfaces, with a number of longitudinal and radial projections (not shown).

Immediately below said rollers 10 and 11, two further similar rollers 13 and 14 arranged in the same horizontal plane but of less diameter than the rollers 10, 11, also rotate in opposite directions, as indicated by the associated arrows, but at different speeds. These rollers are also provided on their surfaces with a number of longitudinal and radial projections (not shown).

The rotation of the shaft 5 is transmitted by means of suitable transmission mechanism 15 to the lower roller 13, the rotation of which is in turn transmitted by means of a chain or belt 16 to the upper roller 10. The rotation of this roller 10 is transmitted to the roller 11 by means of the gears 12 provided thereon. Finally, the rotation of said roller 11 is transmitted, by means of a chain or belt 17, to the lower roller 14 and, by means of another chain or belt 18, to the upper axle 19 of an endless elevator 20 located at one side of the machine and provided with buckets 21 which collect the fruit from a feed hopper 22 and deposit it through a fairing duct 23*a* onto the above-mentioned rollers, to be broken open.

This fairing duct 23*a* forms parts of a box 23, positioned between the supports 8 and 9 and housing the rollers 10, 11, 13 and 14, said box being open at the top, while at the bottom it extends, in the form of an inclined duct 23*b*, into the inside of a drum for extracting fibres, which is mounted on the shaft 5.

Within said box 23 there are also housed (a) two strips 24 located between the upper rollers 10 and 11 and the lower rollers 13 and 14, said strips being convergent so as to form a kind of funnel which, besides clearing away any matter adhering to the surfaces of the upper rollers, acts to guide the fruit falling onto the lower rollers; (b) two further strips 25 designed also to clear away any matter adhering to the lower rollers and thus located adjacent to said rollers; and (c) an inverted V-shaped plate 26 located below the lower rollers 13 and 14, in such a manner that, when the fruit has passed between the rollers and has been broken open by them, said plate separates the rinds from the grains or seeds.

On the shaft 5 is rotatably mounted, following the train formed by rollers 10, 11, 13 and 14, a first drum A designed for the removal of fibres from the fruit after this has been broken open by the rollers. This drum is formed by two large hoops 27 facing each other and provided with a number of arms 28 radiating from hubs or bushes through which the shaft 5 passes and to which said arms are keyed so that, as the shaft rotates, the hoops and therefore, the whole drum rotate therewith.

Both hoops 27 are provided on their inner surfaces, with a circumferential series of support bearings 30 arranged in pairs with each pair on one hoop axially aligned with a corresponding pair on the other. Between the support bearings on one hoop and those on the other are mounted pairs of rollers 31 with the rollers of each pair making tangential contact with one another and being fitted with

peripheral helices 31*a* and also with longitudinal scapers 32 which clean the surface of the rollers and prevent the accumulation of fibrous masses thereon.

The rollers 31 terminate at the support bearings 30 on one of the hoops 27 but extend beyond the support bearings on the other hoop and project from the outer surface of this hoop. The projecting ends of the rollers 31 carry pinions 33 and the pinions on each pair of rollers mesh with one another to allow the rollers of each pair to rotate in opposite directions.

Moreover, the projecting end of each roller 31 carries a second pinion 34, which meshes with a crown wheel 35 by means of which all the rollers in the drum are caused to rotate.

Also, between the hoops 27, in the spaces between the pairs of rollers 31, are arranged a plurality of longitudinally extending V-section plates 36 which, in combination with the rollers, totally close the drum's periphery, the vertex of each plate being directed towards the drum's centre and acting to break up the mass of rinds and fibres.

Finally, the shaft 5 also carries, immediately after the drum A, a second screening drum B, likewise rotatable and formed by a number of vertical and parallel hoops 37 equally spaced from each other, and of a number of longitudinal ribs 38 which connect said hoops to one another and which, by means of arms 39, are connected to hubs or bushes 40 through which the shaft 5 passes.

The frame formed by said hoops 37 and ribs 38 is covered by metallic netting or perforated sheets 41 which totally encircle said frame, the edges of said netting sections or sheets being joined together by means of terminal angular flanges 42.

The sections of the drum between successive hoops 37 are covered by sections of netting or perforated sheet having openings of different diameters, so that a first section 43 allows the passage and therefore, the egress from the drum of small fragments of the rind of the fruit, but not the passage of the grains or seeds which will leave the drum through the succeeding sections.

The arms 39 connecting the longitudinal ribs 38 to the hubs or bushes 40 each have a considerably slanted section 44 so as to more easily move the mass formed by the rinds and grains of the fruit towards an outlet 45, said arms being each further provided with a blade 46 radially oriented towards the inside of the drum for stirring said mass and preventing it from thickening.

The terminal flanges 42 are provided with outer longitudinal scrapers 47 which, while the drum is rotating, traverse a collector 48 located immediately below the drum and conveniently divided by means of a number of small partitions 49 into compartments coincident with the various screening sections of the drum, for receiving the small fragments of rind and the grains or seeds of the fruit which are dragged along by said scrapers 47 and deposited in corresponding collectors 50 situated at the side of the machine.

The operation of the machine is as follows:

When the drive unit 2 is started the shaft 5 begins to rotate, together with the drums A and B which are mounted on and keyed to said shaft. This rotation is simultaneously transmitted to the upper rollers 10 and 11 and to the lower rollers 13 and 14 as well as to the endless elevator 20, whose buckets 21 pick up fruit from the feeding hopper 22 and discharge it through the fairing duct 23*a* and the open upper part of the box 23, onto the upper rollers 10 and 11 which, by means of their longitudinal and radial projections and because of their rotary movement, effect an initial breakage of said fruit.

The strips 24 located below said rollers guide the fruit thus broken, onto the lower rollers 13 and 14, which, by means of their longitudinal and radial projections and their rotary action, complete the fruit breaking operation.

The fruit thus broken is projected through the lower inclined conduit 23*b* of the box 23 into the inside of the drum A in order to separate from said fruit the vegetable fibres which, if passed into the screening drum, would obstruct the openings in its wall and prevent the passage of the grains or seeds. For this purpose, when drum A starts to rotate, the simultaneous rotation of every one of its pairs of rollers 31 occurs. The larger pieces of rind and the grains or seeds of the fruit pass rapidly under their own weight to the next screening drum B, while the fibrous fragments of rind, of considerably less weight, remain in the interior of the first drum A, where they are beaten against the plates 36 and finally pass between the rollers 31 whose peripheral helices 31*a* will discharge them together with small easily transportable fragments of rind.

The pieces of rind and the grains or seeds which pass from the drum A into the drum B are forced to travel along said drum B by the tangential force exerted by the arms 39. The small fragments of rind and the grains or seeds fall from the different sections of the drum through the openings of different diameter in the netting or sheets 41 into the collector 48, where they are separated from each other by the small partitions 49 which divide this collector into as many compartments as there are perforated sections in the drum.

Finally, the scrapers 47 which continuously traverse the interior of the collector 48 while the drum is rotating, remove from said collector the products gathered therein and transfer them to the corresponding collectors 50, while the residues which, because of their large size, have been unable to pass through any of the perforations in the netting or sheets 41, leave the drum B through its front end and are discharged from the machine through the hopper 45.

CLAIMS

1. A fruit shelling machine, characterised by a drive unit mounted on a chassis or frame and operable to rotate a shaft which extends longitudinally of the machine and whose rotational movement is transmitted by means of suitable transmission mechanism (a) to two first rollers arranged in the same horizontal plane and extending between two supports fixed to said chassis or frame, said first rollers being rotatable at the same speed in opposite directions and being provided with a number of longitudinal and radial projections and with meshing gears; (b) to two second rollers arranged in the same

horizontal plane below the plane of the first rollers and of lesser diameter than the latter, said second rollers also being provided on their surfaces with a number of longitudinal and radial projections and being rotatable in opposite directions at different speeds and, (c) to an endless elevator provided with buckets which pick up fruit from a feed hopper and discharge it through a fairing duct, which forms part of a box housing all the rollers, onto said rollers to be broken open by them in two successive operations carried out by the upper rollers and the lower rollers respectively, at the end of which the broken or fragmented fruit is projected through an inclined conduit located at the bottom of said box, into a first drum for separating fibres, said first drum being mounted, together with a second screening drum, on the longitudinal shaft of the machine so as to rotate with it.

2. A fruit shelling machine, according to Claim 1, further characterised in that within said box there are also housed two strips located between the upper and lower rollers, said strips being inclined towards one another so as to form a funnel which, besides clearing away any material adhering to the surfaces of the upper rollers, act to guide the fruit onto the lower rollers, two further strips designed to clear away any material adhering to the lower rollers and thus located adjacent thereto and an inverted V-shaped plate located below the lower rollers for separating the rinds and the grains after the fruit has passed between the rollers and been broken open by them.

3. A fruit shelling machine, according to Claim 1 or 2, further characterised in that the drum for extracting or separating the fibres is formed of two hoops facing each other, said hoops being keyed to the longitudinal shaft of the machine and provided, on their inner surfaces with a circumferential series of support bearings between which extend rollers mounted in pairs with the rollers of each pair in tangential contact and fitted with peripheral helices, said rollers terminating, at one end, in the associated support bearings but, at the other end, projecting beyond the outer face of the corresponding hoop and carrying pinions, pairs of which mesh with one another to cause rotation of their associated rollers in opposite directions, one of the projecting ends of each pair of rollers further carrying a second pinion which meshes with a crown wheel by means of which all the rollers in the drum are caused to rotate, said drum being completed by a number of V section plates having their vertices directed inwards and extending longitudinally between the two hoops in the spaces between adjacent pairs of rollers, in such a way that when the fragmented or broken fruit enters the drum, the larger pieces of rind and the grains or seeds pass rapidly to the next screening drum, while the fibrous masses are beaten against the plates arranged between the pairs of rollers and finally pass out between said rollers, each roller being provided with an outer longitudinal scraper which cleans the surface thereof and prevents the fibrous mass from thickening.

4. A fruit shelling machine, according to any preceding claim, further characterised in that the screening drum, which is mounted on the longitudinal shaft of the machine immediately in front of the drum for extracting and separating the fibres, is formed of a plurality of vertical parallel hoops, equally spaced from each other, and a plurality of longitudinal ribs which connect said hoops to each other and which, by means of inclined arms provided with inner radial blades, are joined to hubs or bushes through which the longitudinal shaft of the machine passes, a cover being mounted on the frame formed by said hoops and ribs and said cover consisting of sections of metallic netting or perforated sheet positioned one after the other and provided with openings of different diameters so that, when the broken fruit from the drum for extraction and separation of fibres enters the screening drum, the perforations in the first of said sections permit the passage of and therefore, the egress from the drum of small fragments of rind, but not the passage of the grains or seeds, which leave the drum through the perforations in succeeding sections to be gathered in a collector located immediately below the screening drum, the boundaries of the successive sections being provided with terminal angular flanges carrying outer scrapers which, when the drum is rotating, continuously traverse the collector and transport the products therein to associated collectors located at the side of the machine.

5. A fruit shelling machine, substantially as hereinbefore described with reference to or as shown in the accompanying drawings.

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