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Schafer et al.

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[54] **METHOD AND APPARATUS FOR THE COMMINUTION OF WOOD**

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[51] **Int. Cl.**.. **B27l 11/00**
[58] **Field of Search** .... 241/28, 91, 92, 93, 241/277, 278 R, 280; 144/172

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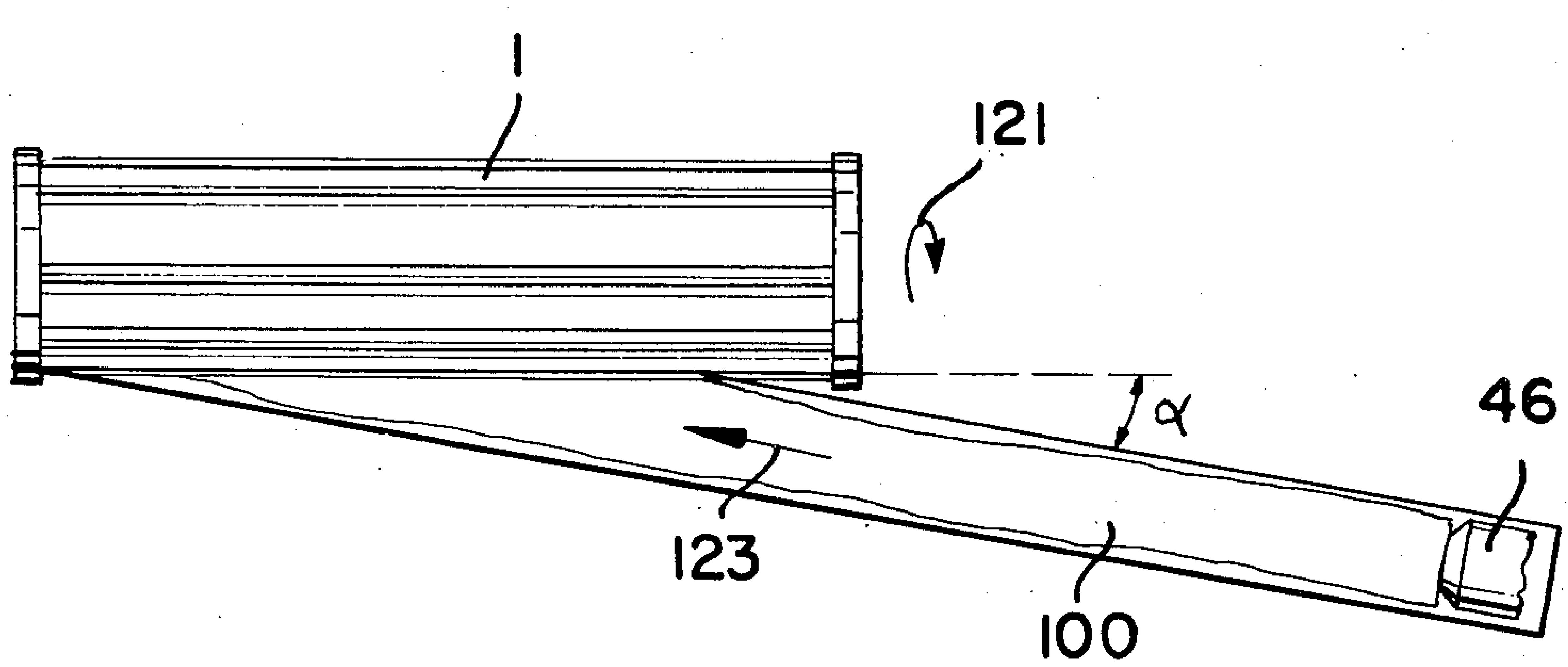
[57] **ABSTRACT**

Pointed wood particles for use in the production of pressed board or in the paper or cellulose industries are made by shaving a wood body in the direction generally transverse to a major dimension thereof and inclined at an acute angle to the grain to produce shavings which are thereafter broken up to form the particles. The apparatus comprises a drum whose blades along the exterior are provided with slots through which the shavings pass into the interior of the drum and are conveyed by a worm, belt or flight conveyor within the latter.

14 Claims, 12 Drawing Figures



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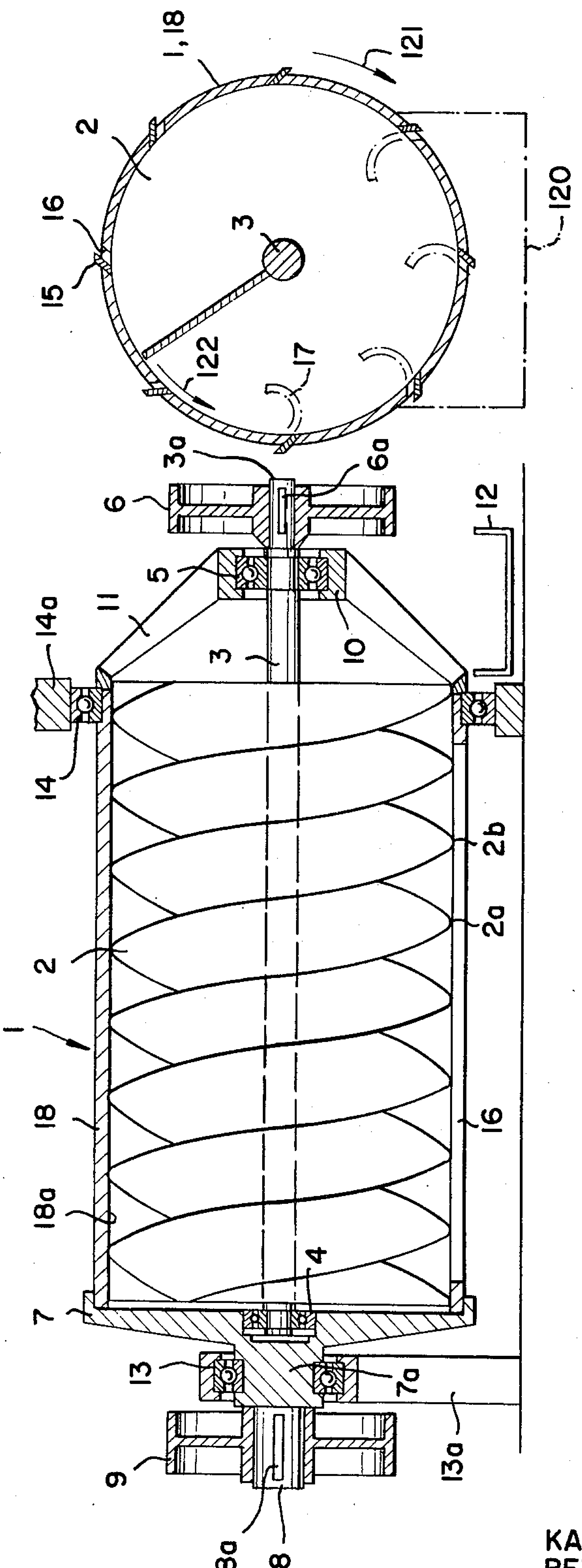

FIG. 1

FIG. 2

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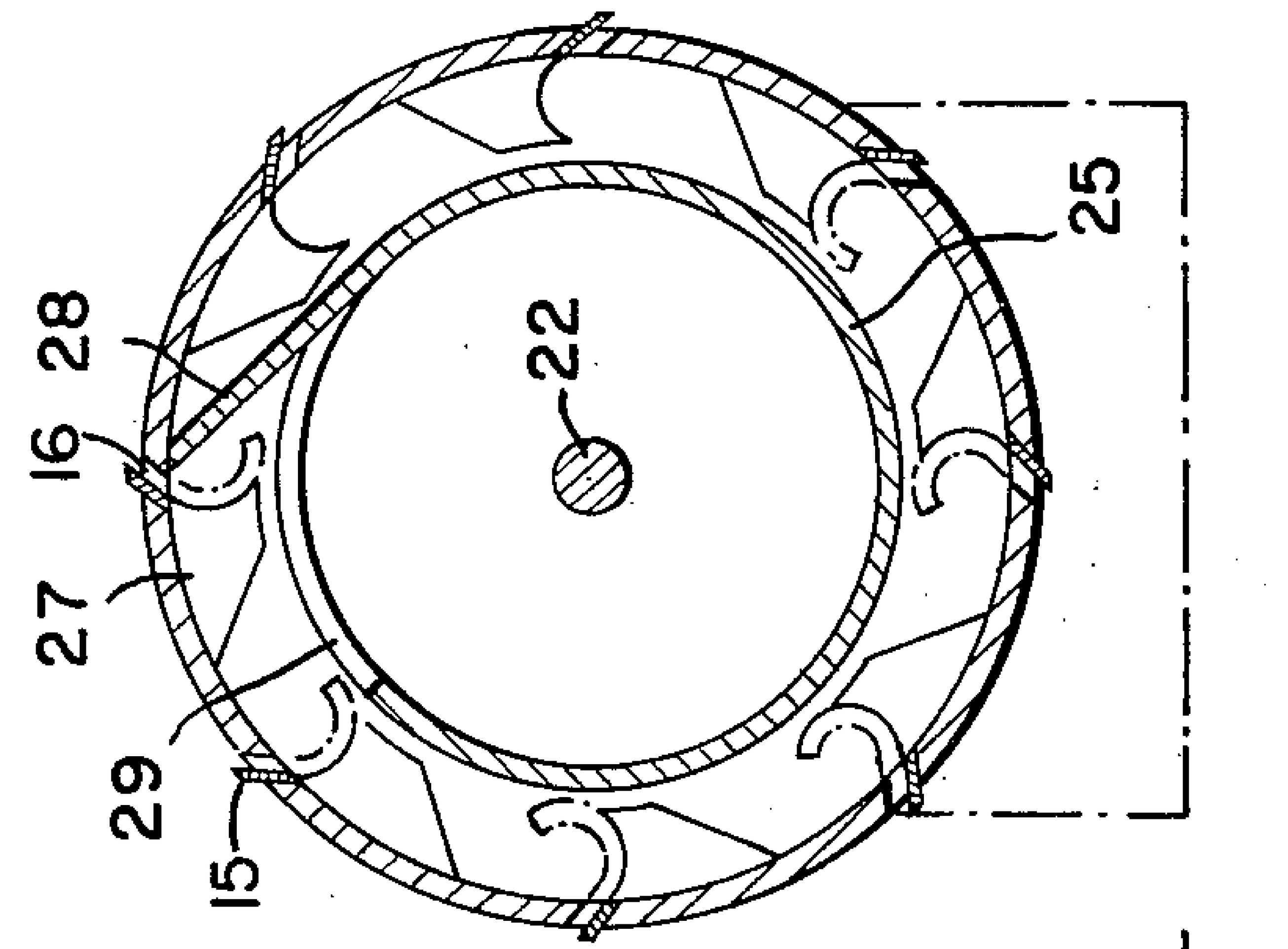

FIG. 4

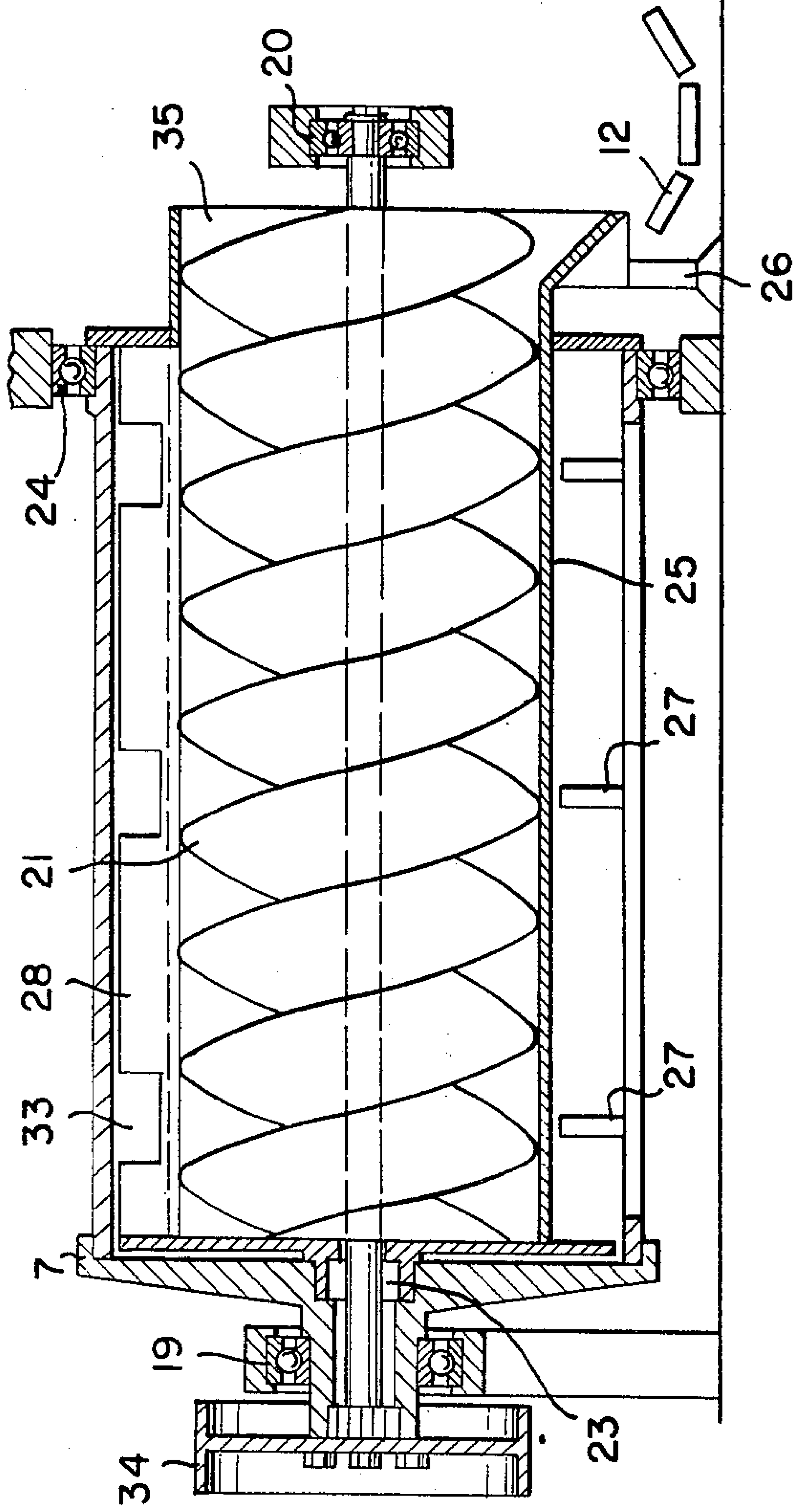

FIG. 3

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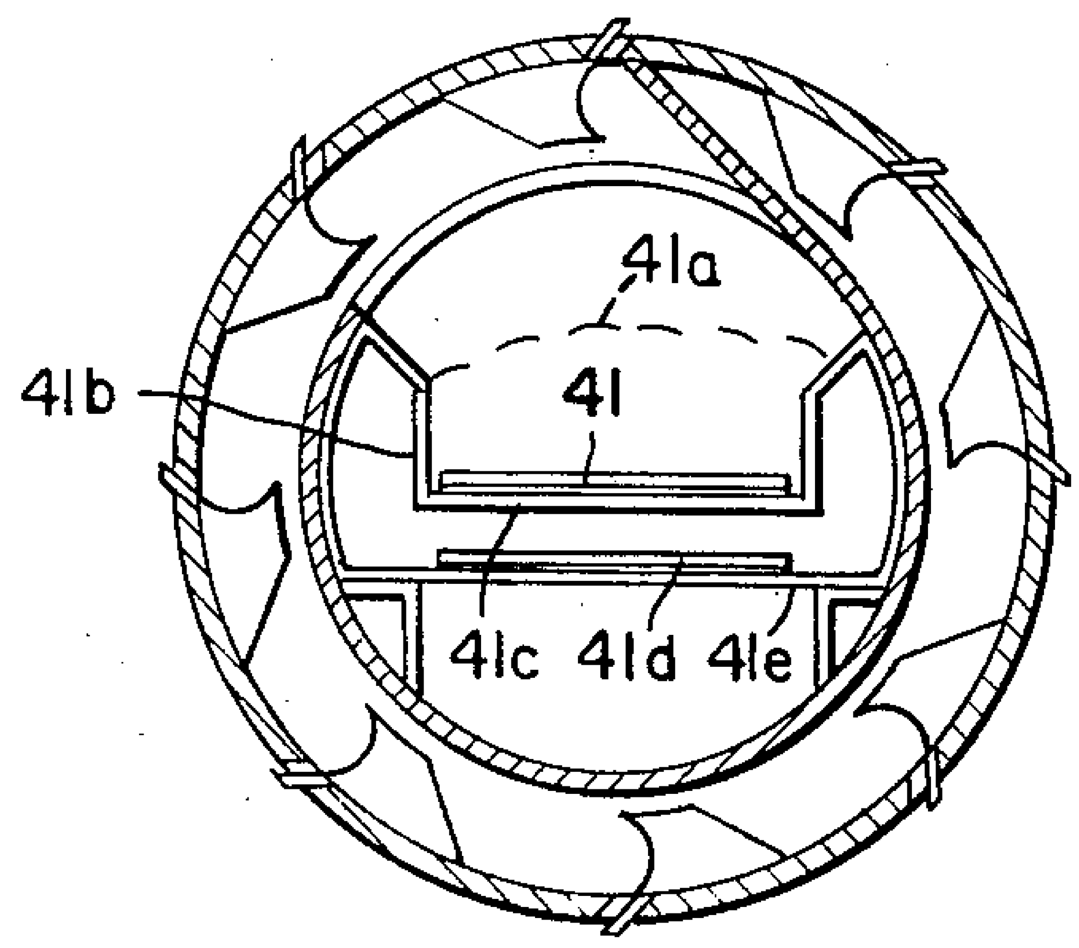
F I G .5



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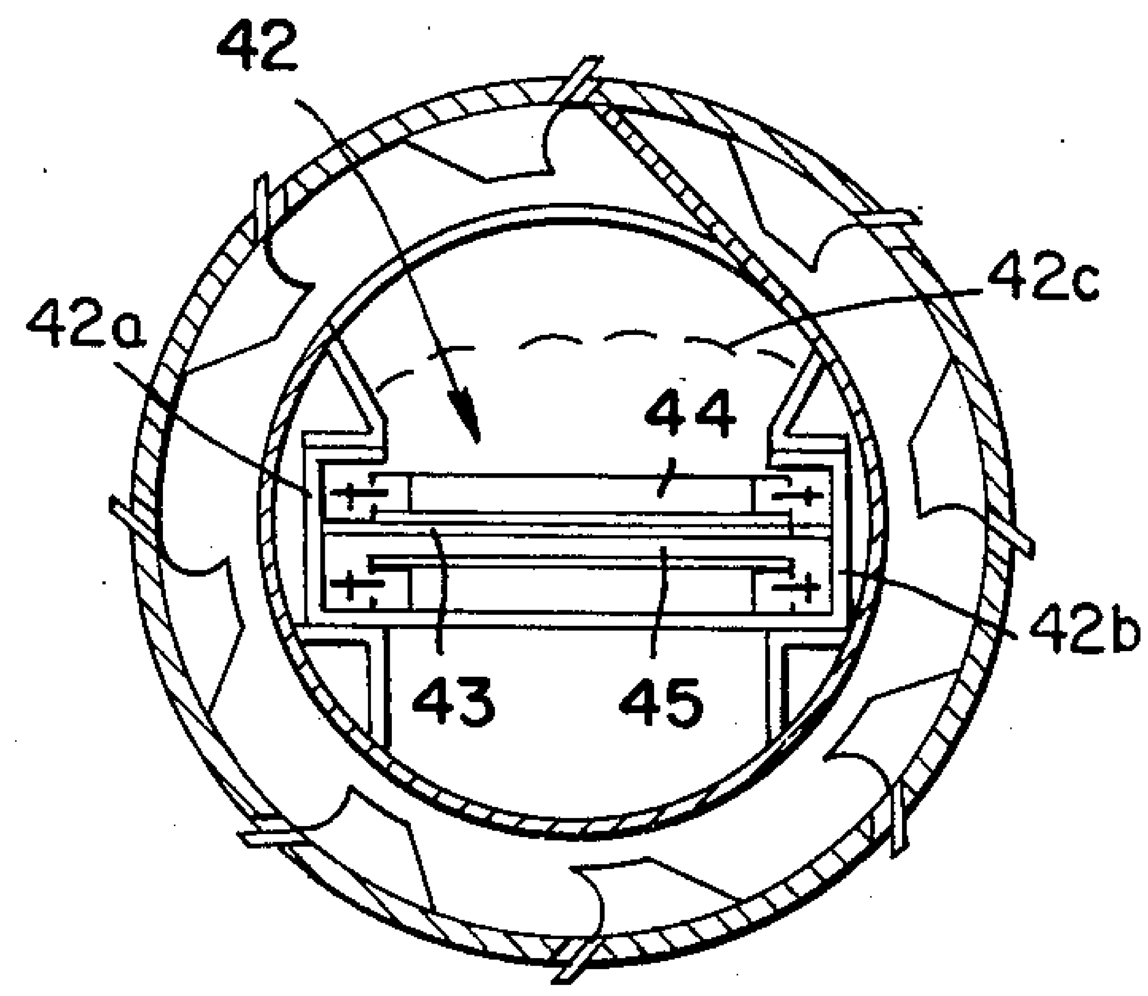

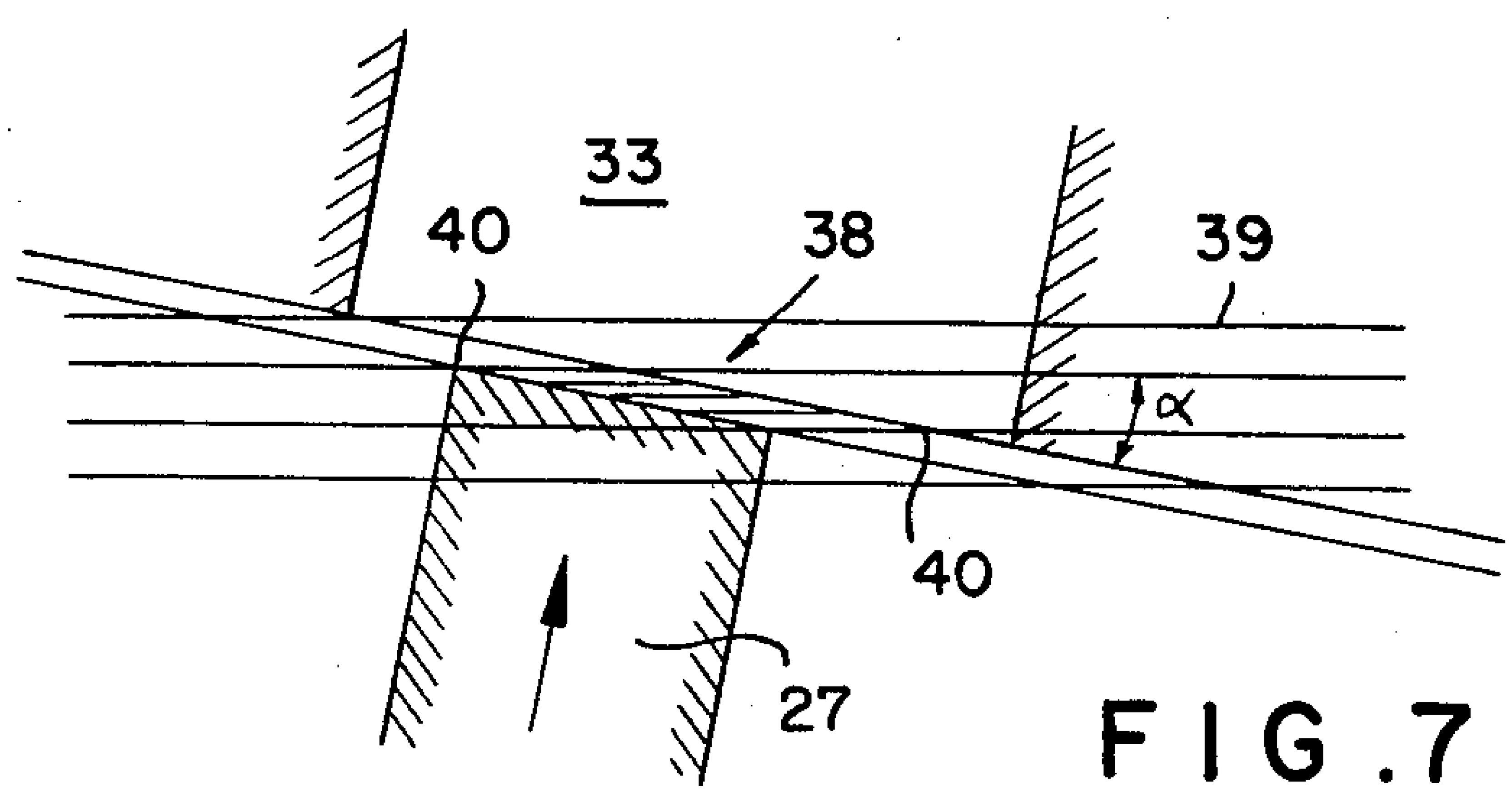

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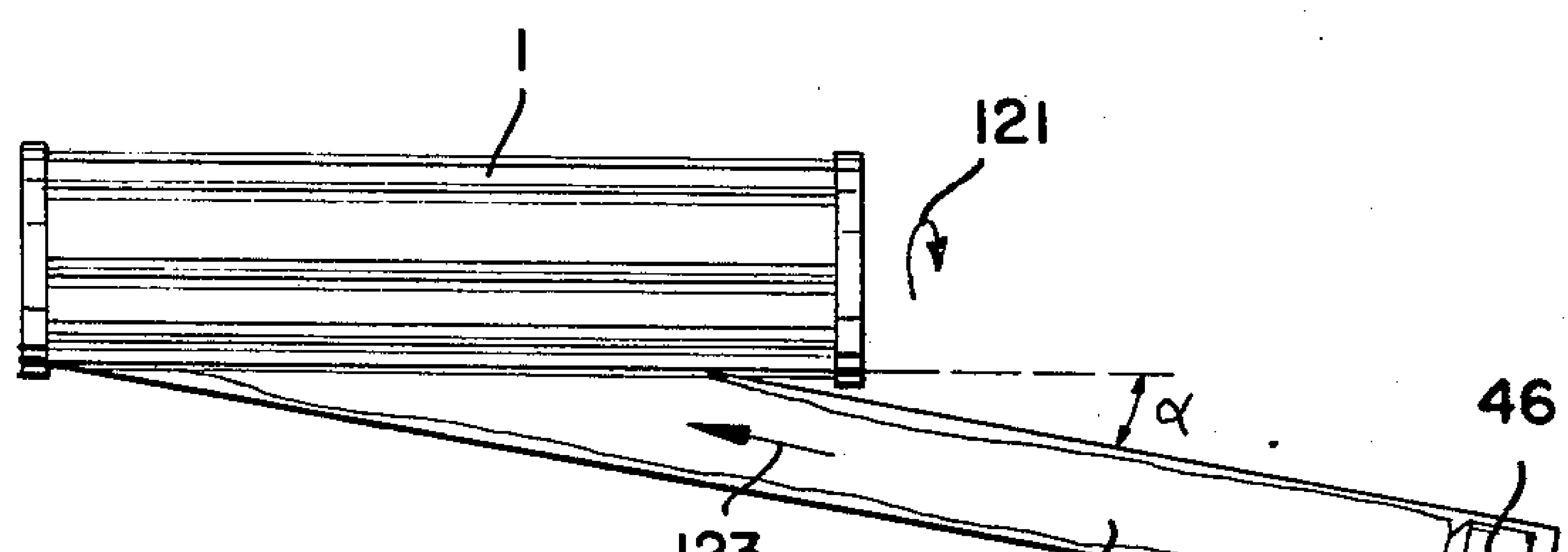

F I G .8

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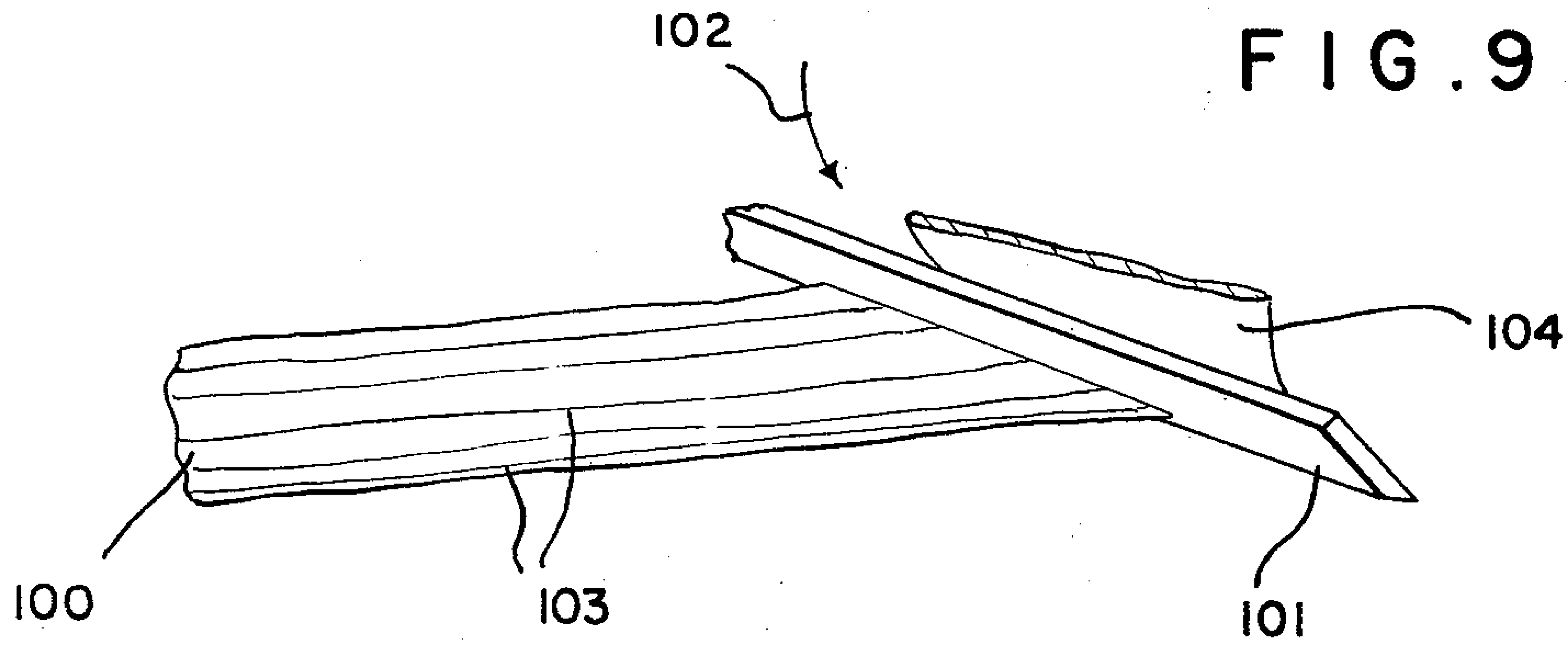
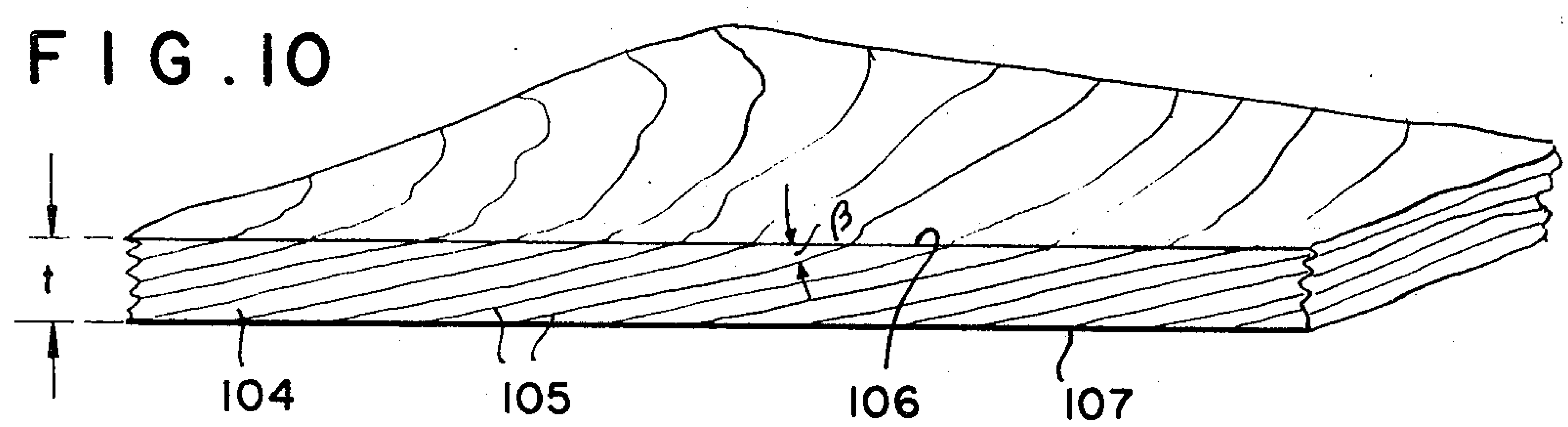


FIG. 9

FIG. 10



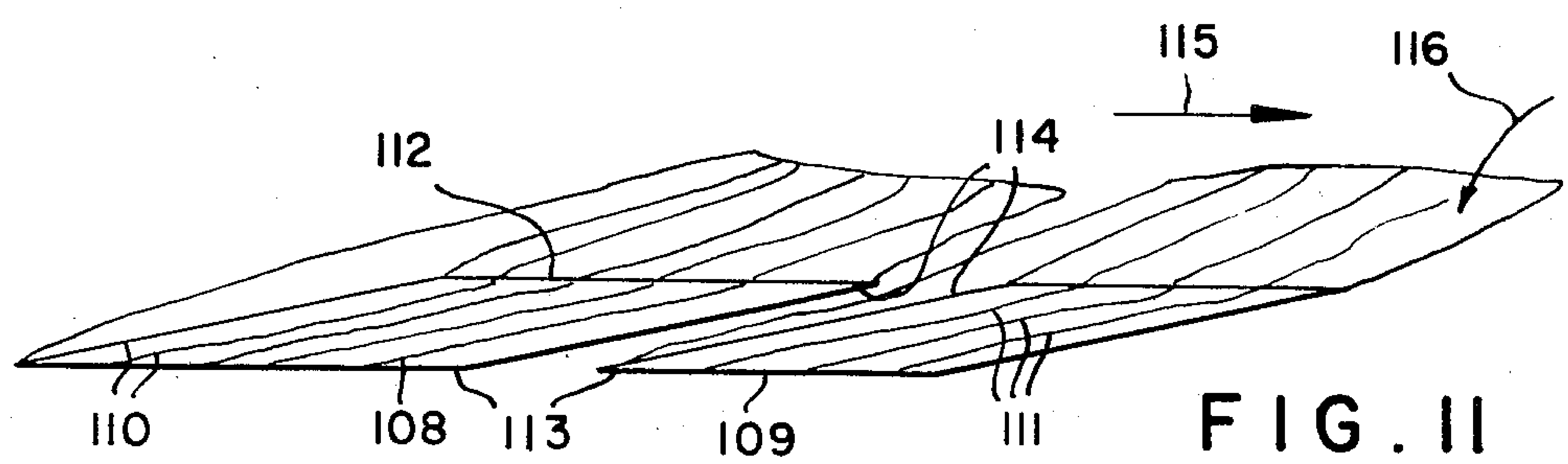


FIG. 11

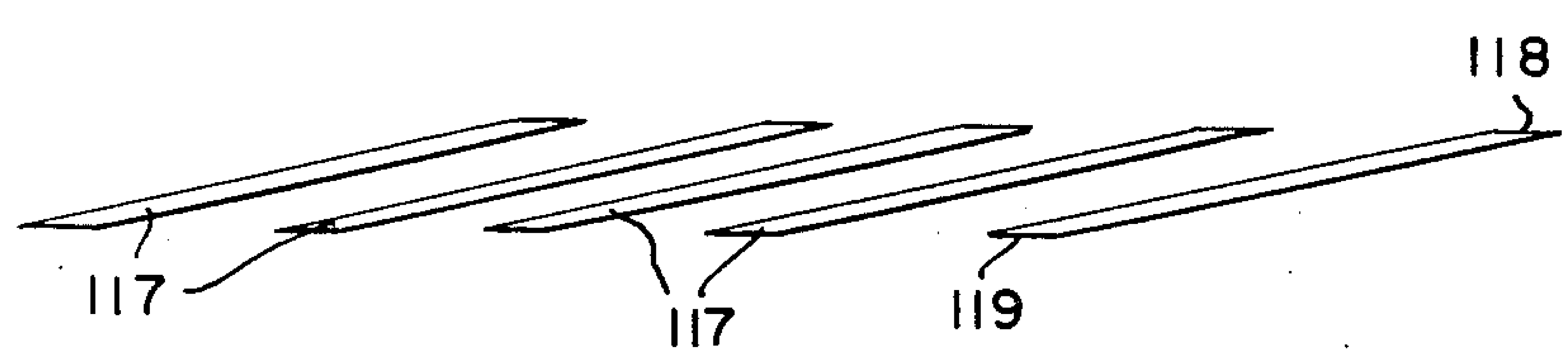


FIG. 12

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METHOD AND APPARATUS FOR THE COMMINUTION OF WOOD

FIELD OF THE INVENTION

Our present invention relates to a method of and an apparatus for the comminution of wood and, more particularly, to a method of and an apparatus for producing wood particles, especially for use in pressed board or in the paper or cellulose trades.

BACKGROUND OF THE INVENTION

It is a common requirement for various industrial processes that wood particles be supplied from a source of waste material or as a raw material from wood bodies such as tree trunks and the like which are harvested especially for this purpose.

For example, in the production of pressed board, cellulosic fibers or wood particles (e.g., sawdust, chips, shavings or splinters) are generally required and may be milled or otherwise subdivided and can be graded or used in a wide particle-size range to form mats in the presence of binder materials which are intrinsic to the wood or are supplied from some external source. The fiber mat or mat of loosely coherent or noncoherent particles may be conveyed upon a tray or upon a conveyor surface to a stacking rack and introduced between platens of a multiplaten press or pressed individually in a roller press or a platen press. Compression under heat and pressure results in a "pressed board," also known as particle board or fiberboard. Such pressed board may have a core layer of particles of one size, sandwiched between or flanked by cover layers or outer layers of particles of a different size (generally finer than the core layer) to provide a less porous surface of greater esthetic value and improved texture.

Pressed board may be made in a wide variety of thicknesses and sizes, depending upon the requirements and various parameters and in a variety of densities ranging from a highly cellular, light-weight and porous structure of considerable volume for insulation, to a highly dense, rigid and strong structure of considerable value in construction. The critical parameters, aside from the nature of the wood particles, the particle size and the particle size and the particle configuration, are of course the degree of compression, the quantity, character and nature of any thermosetting resins used as binders, the moisture content of the particles and the processing of the fiberboard.

We may also mention that wood particles are useful in other technologies as well, namely in the production of paper or cellulosic products, e.g., regenerated cellulose. For example, in the production of paper and cellulose, wood particles are digested to break down the natural resins which hold the cellulosic fibers together, thereby forming fibrous masses consisting primarily of cellulose. Thus, it is evident that the comminution of wood to produce wood particles is of considerable interest.

In all of the above industries it is desirable to maintain the wood particles in a form which contributes to the characteristics of the end product and, therefore, provides some sort of directionality which may be employed to increase the strength of the product. Consequently, in the paper and cellulose production industries, the wood particles preferably are elongated so as to yield fibers of a length sufficient to the end result.

It is known, more specifically, in connection with the production of pressed board to derive the wood particles as a waste product from some other manufacturing process involving wood. This waste product may be chips, shavings and sawdust derived from furniture plants, lumber mills and the like. In addition, it is known to comminute wood as a raw material especially for the production of wood-fiber board.

In prior-art systems of the latter type, a log or other massive wood body having a grain orientation generally in the longitudinal direction may be shaved or chopped into thin leaf-like elements having a thickness of 0.2 to 0.6mm. Chips of a thickness of 0.4mm (approximately) are commonly used for the core or central layer of multilayer pressed board while chips of a thickness of 0.2mm (approximately) may be used for the cover, facing or outer layers of the wood-fiber board. The comminuting process is, however, relatively expensive because, firstly, large wood bodies must be manipulated because wear of the cutting blades is relatively high and because considerable energy is necessary to drive the system. In practice, energy costs of 20 to 40 kWh/metric ton of comminuted wood are not unusual. The blades have a useful life on the average of 2 to 4 hours in comminuting machines which have a capacity of 6 to 8 metric tons of wood particles in this period, when small particles are made, and a useful life of 20 metric tons when particles are produced for the core layer of the pressed board. Not only are the costs high for the sharpening, adjustment and replacement of the worn blades, but the downtime of the apparatus is considerable if a large number of blades is provided.

It has also been suggested to substitute for the shaving process described above, a wood-chopping process whereby the wood is comminuted by the chisel-like impact of massive blades thereagainst. Such wood-chopping characterizes the production of wood particles in the paper and cellulose industries. Wood-chopping machines may have an output of 20 to 60 metric tons/hour. However, the chips produced by the process frequently must be further comminuted by, for example, blade-ring comminuters which have the disadvantages discussed above of high-blade wear, energy cost and downtime or replacement cost. When the two comminution steps are taken together, they have even greater disadvantages than the shaving system mentioned earlier. Finally, we may mention that the latter system frequently produces wood particles whose characteristics are poorer than those of the shaving system mentioned earlier for many purposes.

For example, a chopping machine of conventional construction may operate with energy cost of 20 kWh/metric ton of comminuted wood, to which must be added the operating costs of the further comminution stage. To limit these costs, it has been suggested to avoid the further mechanical comminution stage and to introduce the wood chips directly into a refining apparatus in which pressure, heat and the like are used to break down the wood structure and form fiber bundles therefrom which may be used in the usual manner in the paper and cellulose industries and which may be dry-pressed to produce fiberboard. Even this system has significant disadvantages since the energy costs of operating the refining devices with wood chips derived directly from the chopping apparatus is higher than mechanical comminution. When the refiner is operated in a wet mode, excessive softening of the chips occurs to the extent that the product may be treated in a so-called defibrator; the product, however, is excessively fluffy for use in the dry-pressing of fiberboard. As a consequence, the dry process for producing fiberboard can be carried out only with hard fibers and only to yield thin sheets or plates.

As far as the prior-art comminuting devices are concerned, we also must make mention of the fact that, for the production of paper and in the cellulose industry, it is desirable that the wood particles which are used have an "acute-angle character," meaning that the grain structure and the major longitudinal dimension of the particle should lie at an angle to the end face. It has been proposed to produce shaving and chopping machines in which a plurality of blades are angularly spaced about a drum and the block, body or log of wood is fed to the latter so that the blades chip away and split particles from the wood. These particles are generally nonuniform and have undesirable characteristics for many purposes in the paper industry. To obtain greater uniformity and the aforementioned acute angles, it is not uncommon for a central blade to be fed transversely to the grain and to be flanked by two acute-angle blades whose cuts define the end phases. Such systems produce deformation-free particles of high quality but the machine operation is disadvantageous since complicated shaving processes at considerable expense in time and money are required to prepare the many blade surfaces.

Drum-type choppers whose blades lie in helical patterns along a conical drum have also been provided. The particles are produced with the desired inclination, i.e., with a cut intersecting the grain direction at an acute angle, although the drum-type chopper offers difficulty with respect to replacement, sharpening and readjustment of the blades. A further significant disadvantage of these conventional drum-type choppers is that the wood, before it is fed to the machine, must be cut to the length of the machine or drum.

OBJECTS OF THE INVENTION

It is an important object of the present invention to provide a method of and an apparatus for the comminution of wood whereby high-quality particles may be obtained at relatively low cost and without any of the disadvantages of the systems described earlier.

It is another object of the invention to provide an improved method of producing wood particles, especially for use in the production of pressed board, whereby the particles have improved characteristics and uniformity and whereby the method of production is of lower cost than prior-art systems.

Still another object of the invention is the provision of a wood-comminuting apparatus in which the cutting members can be conveniently and readily replaced, sharpened or removed, in which higher quality wood particles can be provided, and in which the energy cost is reduced.

Yet a further object of this invention is the provision of a wood-comminuting apparatus for producing acute-angle wood particles which are especially desirable in the paper and cellulose industries.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with the present invention which in one of its vital aspects provides a method of producing wood particles for the production of pressed board. The method comprises the steps of shaving from a wood body having a predetermind grain orientation leaf-like shavings of a thickness of 1 to 5mm, preferably 2 to 3mm, in a direction generally transverse to the grain orientation but at an acute angle of substantially 7° to 20° to the grain, whereby the grain includes an angle of substantially 7° to 20°, preferably 12° to 15°, to the cut surface of the shaving; and thereafter breaking the shaving along the grain to produce generally flat particles. Finally, these particles are dry-milled to produce chips and fiber bundles with pointed ends.

The formation of the shavings is carried out generally in the manner of veneer production except that the wood body is fed at an acute angle to a drum-type shaving apparatus so that the blades sever the shavings in the direction generally transverse to the grain orientation. Cutting in this manner requires small amounts of energy. The subsequent crumbling or breakdown of the shavings during the milling step likewise requires little energy because the shavings naturally tend to crumble or separate parallel to the wood fibers. It is possible in this fashion to break down the generally flat pieces broken initially from the shavings into fine fiber bundles which are used for the cover layers or facing layers of the fiber wood and into relatively coarse fiber bundles or chips suitable for use as the core layer of the pressed board.

According to another feature of this aspect of the invention, the flat pieces broken from the chips are subjected under atmospheric pressure to steam (steaming) to produce fiber bundles and particles especially useful in the subsequent pressing to produce fiberboard. We have found that cutting speeds (i.e., the rate at which the shavings are formed) can be about 6 meters per second for optimum comminution. The cutting drum of the present invention thus can operate at speeds substantially slower than the 40 meters per second of conventional chopping machines, thereby reducing the centrifugal forces which might otherwise retain the wood particles against the inner surface of the drum.

According to a further aspect of the invention, the apparatus comprises, in addition to the cutting drum, which is generally cylindrical and is provided with an array of outwardly projecting angularly equispaced blades, a conveyor worm within the drum which is provided with slots through which the shavings pass, the conveyor drum serving both to advance the particles from the apparatus and as a milling device for further comminuting the shavings. The shaving blades lie along secants of the drum and project only slightly therebeyond, while extending axially along the drum periphery and are disposed immediately adjacent the slots which also can open into the drum along secants thereof.

A feed means is provided for urging the log or body of wood toward the drum at the aforementioned acute angle, preferably 9° to 15° with a generatrix of the drum or the drum axis. At this angle, the shavings pass into the drum and break up upon contact of the shavings with the worm so that the relatively rotating members need overcome only the forces of adhesion between the fibers which are never cut transversely to the grain. The worm extends coaxially within the drum and may have its generatrix reaching substantially to the inner wall of the drum. Moreover, the worm may be rotated in a direction opposite that of the drum so that the drum and the worm are counterrotating. Since the lengths of the shavings are independent of the spacing between the blades or slots but is a function of the frequency of contact of the turns of the worms with the shavings (i.e., the frequency with which a turn of the worm sweeps across each slot) it is advantageous to provide the worm of the multiple-thread type.

According to another feature of the invention, the hollow drum, which rotates about a horizontal axis provides at its discharge side a storage cover or member in which the fiber bundles or particles, produced by the milling effect of the counterrotating drum and worm can accumulate.

Alternatively, the inner wall of the drum may be provided with entraining members or scoops located adjacent the slots and serving both as guides and as comminuting members which cooperate with interleaved rake-like formations fixed in the interior of the drum to break up the shavings.

The discharge device may extend axially through the drum and may be provided in a coaxial but stationary trough whose opening extends along the stripping teeth of the rakes to catch the comminuted shavings.

The lengths of the particles is here determined by the transverse spacing of the entraining scoops and the cooperating teeth so that a narrower spacing results in shorter particles.

A plurality of such strippers may thus be provided one behind the other and may have means for adjusting the relative spacing of the strippers.

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. **1** is an axial cross-sectional view through a wood-comminuting drum according to the present invention;

FIG. **2** is a transverse cross-sectional view of the drum of FIG. **1**;

FIG. **3** is an axial cross-sectional view, similar to FIG. **1**, illustrating another embodiment of the invention;

FIG. **4** is a transverse cross-sectional view through the drum of FIG. **3**;

FIG. **5** is a view similar to FIG. **4** of still another embodiment of the invention wherein conveyor belts serve to move the comminuted product;

FIG. **6** is a view similar to FIG. **4** of an embodiment in which a scraper conveyor serves as an additional comminuting device;

FIG. **7** is a diagrammatic view illustrating the formation of a wood particle according to the present invention;

FIG. **8** is a diagram illustrating how the body of wood is fed to the drum;

FIG. **9** is a diagram illustrating a feature of the invention;

FIG. **10** is a diagrammatic perspective view showing the wood shaving prior to initial breakup;

FIG. **11** shows how the shaving is initially broken; and

FIG. **12** is a diagram illustrating the comminuted product.

SPECIFIC DESCRIPTION

Referring first to FIGS. **9** and **11**, it will be seen that, in general, the wood body **100** is fed at an acute angle to the blade drum of which one blade is shown at **101** in FIG. **9**. While, in general, the blades are carried by a drum (FIGS. **1** – **8**) rotatable about a horizontal axis and the wood is fed to the drum generally laterally (FIG. **8**), the method aspects of the present invention may best be understood by recognizing that each blade **101** sweeps the log **100** in an arc represented by the arrow **102** and, because of the acute angle, moves generally transversely to the grain orientation **103** but slices the wood substantially parallel to the grain to form the shaving **104**.

The term "substantially parallel" is used herein to refer to a shaving of the wood at an acute angle of 7° – 20° to the grain orientation, preferably 9° – 15° and, even more advantageously, 12° – 15°. The shaving **104**, as best seen in FIG. **10**, thus has its grain orientation **105** running at an acute angle β of about 12° to the surface **106** or **107**, one of which is formed by the preceding cut while the other is formed by the current cut. The shaving preferably has a thickness (FIG. **10**) which ranges between 1 and 5 mm and is about 2 mm as represented in the drawing in approximately 5-times enlargement. The preferred thickness is about 2 – 3 mm.

After the shaving **104** is removed from the wood body, it may be preliminarily broken up as shown in FIG. **11** into two flat chips (small pieces) **108** and **109**, each of which has a grain orientation **110** and **111** running at the acute angle β to the upper and lower surfaces **112** and **113**. Since the subsequent breakdown of the basic shaving takes place parallel to the grain orientations **105, 110, 111**, the separation between the chips **108** and **109** takes place at **114** along the grain and requires overcoming any of the adhesion forces between the grain planes. This breakdown of the shaving occurs almost naturally as the shaving is fed in the direction of arrow **115** and encounters a milling member moving in the direction **116**, i.e., intercepting the leading edge of the shaving. Subsequently, the chips **108** and **109** are broken down by aftermilling in a similar manner into wood particles **117** having pointed ends **118, 119** resulting from the angle at which the log was originally fed to the drum.

Surprisingly, the present technique producing comminuted wood has been found to be highly advantageous for the production of pressed board from the particles **117**, especially where these particles are used in the core layer of the pressed board. Because of the pointed ends of the particles, the resistance of the board to transverse stress is greater while the swelling of the board by absorption of moisture is reduced. The structure of the core layer is substantially more dense and closer than with other wood-chip board and the resistance of the board to breakdown when nails and screws are driven into it is increased. In addition, blade replacement, sharpening and adjustment costs are lowered while the energy required for comminuting the wood is reduced. Prior to milling the pieces of wood are subjected to steam treatment at atmospheric pressure.

In FIGS. **1** – **8**, we have shown the system for comminuting wood in several embodiments and in somewhat greater detail. The machine of FIG. **1**, for example, comprises a horizontal drum **1** which coaxially receives a worm **2** having a shaft **3** journaled in bearings **4** and **5** at opposite ends of the drum. The worm **2** is of the multiple-thread type and in the embodiment shown as a double-pitch thread whose turns are represented at *2a* and *2b*. The worm **2** is driven by an electric motor via a belt drive connected to a pulley **6** keyed at **6***a* to the end **3***a* of shaft **3** projecting outwardly beyond the bearing **5.** The turns, threads or lands of worm **2** reach to the inner wall **18***a* of the cylindrical shell **18** of the drum and sweep across the slots **16** formed therein to guide the shaving **17** into the drum interior. The outer periphery of the worm **2** is thus defined by a generatrix which coincides with the generatrix of the inner cylindrical wall of the drum.

The hollow drum **1** is provided at one end with a bearing cover or plate **7** into which the cylindrical shell is fitted, and having a cylindrical base *7a* journaled in the bearing **13** of a support **13***a*. A stub **8** of the base *7a* projects axially beyond the bearing **13** and is keyed at **8***a* to a pulley **9** connected to a beld drive for the drum. In this embodiment, the worm is rotated in one sense while the drum is rotated in the other. In FIG. **2,** for example, a wood body is shown at **120** to underlie the drum **118** which is rotated in the direction of arrow **121** (clockwise) while the worm **2** is rotated in the opposite direction (arrow **122**) or counterclockwise.

The bearing holder **10** at the other end of the drum receives a bearing **5** and is provided with a spider **11** through which the comminuted wood can be discharged. A bearing **14** supports the outer periphery of the drum **118** adjacent this end in a support **14***a*. As best seen in FIG. **2,** the outer periphery of the drum is formed with blades **15** in angularly equispaced relation, the blades **15** projecting slightly beyond the outer drum surface and lying along respective secants of the cylinder. Each blade **15** extends axially along the drum and is disposed adjacent the respective slot **16** through which the shaving **17** may pass.

In operation, a feed device, represented at **46** in FIG. **8,** serves to advance the body of wood **100** against the drum **1** in the direction of arrow **123** and includes an angle α of 9° – 15° with a generatrix of the drum, the drum being rotated in the counterclockwise sense as represented by the arrow **121** also illustrated in FIG. **8.** The speed of advance of the log and the peripheral speed of the drum are such that shavings are produced at a rate of approximately 6 meters per second.

As seen in FIG. **2,** shavings **17** pass through the slots **16** into the interior of the drum where they are broken up by the counterrotating worm **2** and transformed into the pieces **108, 109** and then into particles such as those shown at **117** in FIGS. **11** and **12.** The particles are advanced by the worm to the spider **10** where they fall between the arms of the spider and into the trough **12** which may be provided with a belt, flight or scraper conveyor as described at pages 7 – 6 ff of PERRY'S CHEMICAL ENGINEERS' HANDBOOK, McGraw-Hill Book Company, N.Y., 1963.

As we have noted earlier, the feed of the wood body to the drum at the acute angle and the shaving motion of the blades transverse to the wood fibers represented at **39** in FIG. **7** produces the shavings **17** (FIG. **2**) which are then broken up into small chips or particles **38.** The slots of the drum are represented at **33** (analogous to slots **16**). Since the fibers **39** run parallel to the original direction of feed, the ends **40** of the particles **38** are pointed or are at acute angles to the length of the particle. Member **27** represents an entrainer as described in connection with FIGS. **3** and **4,** infra.

In FIGS. **3** and **4,** we have shown a comminuting device in accordance with another embodiment of the invention. In this case, the drum is journaled in bearings **19** and **24** in the manner previously described but is rigidly connected along its interior with a coaxially arranged worm **21** whose shaft **22** is supported in a worm-trough bearing **23.** The other end of this shaft is mounted in a bearing **20.** The worm **21** is surrounded except along its upper side with the worm trough **25** fixed at **26** to a stationary part of the system whereby both the worm and the drum rotate relative to this trough. The drum is here also provided with blades and slots as shown at **15** and **16** in FIGS. **1** and **2,** each slot being provided along the inner surface of the drum with a guide scoop or entrainer **27** (see FIGS. **3** and **4**). Each of the entrainers has a plurality of axially spaced fingers as shown at the bottom in FIG. **3.** The entrainers **27** cooperate with strippers **28** fitted to the trough **25** and forming rake-like members interleaved with the teeth of entrainers **27.** The strippers **28** are relatively adjustable or shiftable. To this end, the strippers **28** are provided with slots **33** through which entrainers **27** pass.

The upper portion of the trough **25** is open along its entire length ahead of the stripper **28** to define an inlet **29** into which the broken shavings pass. The drum **1** and the worm **21** are driven by a pulley **34** from a belt arrangement not shown and connected via the bearing cover **7** as previously described to the drum.

In this embodiment as well, the body of wood to be comminuted is fed at an acute angle against the rotating drum and is shaved to produce the foils which are broken up longitudinally as the members **27** pass the stripper **28.** In addition, the relative movement of the drum and the stripper breaks down the shaving as described in connection with FIGS. **11** and **12** to produce the particles **117.** The particles fall into the trough **25** and are entrained by the worm **21** out of the machine through the discharge end **35** of this trough. The particles are led away on the conveyor arrangement **12.**

In FIG. **5,** we have shown a modification of the system of FIG. **4** wherein, in place of the screw-type conveyor of this latter Figure, a conveyor belt **41** is provided for carrying away the particles. In the arrangement of FIG. **6,** a scraper-type conveyor is provided at **42** above a perforated plate **43** or grate which cooperates with the scraper flights to further comminute the particles. An underlying trough **45** then receives the particles which can be removed, e.g., by a belt conveyor. Belt and flight conveyors of the type used in the systems of FIGS. **5** and **6** are described in the aforementioned publication.

As explained in PERRY'S CHEMICAL ENGINEER'S HANDBOOK, the belt conveyor of FIG. **5** carries the mass of particles **41***a* upon a belt **41** received in an upwardly open trough **41***b*, the belt riding upon a support surface **41***c*. The return pass **41***d* of the belt is supported on a lower surface **41***e*. The belt may pass over rollers as shown at its opposite ends and can be driven in a manner well known in the art.

In FIG. **6** the flight conveyor has its upper base **44** displaceable by chains along the perforated surface **43** within a trough formed by walls **42***a* and **42***b*, to carry the particles **42***c* in the axial direction. The system operates otherwise in a manner similar to that of FIG. **4** and the cooperation of the flights with the perforated surface fsurther comminutes the particles.

We claim:

1. A method of producing wood particles, comprising the steps of shaving a body of wood having a predetermined grain orientation in a direction transverse to the grain orientation but intersecting same at an acute angle of substantially 7° to 20° to produce shavings having a thickness of 2 to 3 mm and having a grain extending at an angle of substantially 7° to 20° to the cut surfaces of the shaving; and breaking said shavings into particles along the grain of the shavings whereby said particles have acute-angled ends by feeding said shavings in the direction of the grain thereof against a transversely moving surface.

2. The method defined in claim 2 wherein , in the step of breaking said shavings into particles, said shavings are first broken into smaller pieces and said pieces are thereafter milled to produce said particles.

3. The method defined in claim 2 wherein prior to milling of said pieces and after the shavings are broken into smaller pieces, said pieces are treated with steam at atmospheric pressure .

4. The method defined in claim 1 wherein said shavings are removed from said body at a speed of 6 meters per second.

5. An apparatus for comminuting wood, comprising a drum rotatable about an axis, a plurality of angularly spaced axially extending shaving blades mounted in said drum and projecting outwardly thereof for cutting respective shavings from a wood body urged against said drum, said drum being formed with respective slots adjacent each of said blades and passing the respective shavings into the interior thereof, means for feeding a wood body at an acute angle of substantially 9° to 20° to the drum axis against the periphery of said drum, and means within said drum for comminuting said shavings and conveying the wood particles resulting from comminution of said shavings out of said drum.

6. The apparatus defined in claim 5 wherein the last-mentioned means includes a conveyor worm rotatable within said drum.

7. The apparatus defined in claim 6 wherein said conveyor drum has at least one thread closely approaching an inner wall of said drum, further comprising means for driving said drum and said worm in opposite senses whereby said worm engages said shavings as they pass through said slots to comminute said shavings.

8. The apparatus defined in claim 6, further comprising a trough receiving said worm, said worm being coupled with said drum for rotating jointly therewith, entraining fingers formed on the interior of said drum for carrying said shavings therewith, and a stripper interleaved with said fingers and mounted on said trough for cooperating with said fingers to break up said shavings and deposite same in said trough.

9. The apparatus defined in claim 5 wherein the last-mentioned means includes a trough extending in said drum and having an upwardly open portion, entraining means mounted along the interior of said drum for entraining said shavings therewith, a stripper mounted on said trough and interleaved with said entraining means for comminuting said shavings to produce wood particles and depositing same in said trough.

10. The apparatus defined in claim 9 wherein a plurality of such strippers is provided.

11. The apparatus defined in claim 9, further comprising a conveyor worm rotatable in said trough for advancing said particles out of the latter.

12. The apparatus defined in claim 9, further comprising a belt conveyor in said trough for advancing said particles out of the latter.

13. The apparatus defined in claim 9, further comprising a flight conveyor in said trough for advancing said particles out of the latter.

14. The apparatus defined in claim 13, further comprising a perforated plate cooperating with the flights of said conveyor for further comminuting said particles.

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