FORM 25 (12) PATENT granted by (19) AP

AFRICAN REGIONAL INTELLECTUAL PROPERTY ORGANIZATION (ARIPO)

1332

(11) (A)

(21) Application Number: AP/P/2001/002024

(22) Filing Date: 03/01/2001

(24) Date of Grant & (45) Publication: 26/11/2004

(30) Priority Data

(33) Country : AR

(31) Number: P000100042

(32) Date: 06/01/2000

(84) Designated States: KE MW UG ZW

(73) Applicant(s):

SNIECHOWSKI Hugo José
Rivadia 1030,
(3360) Oberá-Provincia de Misiones,
ARGENTINA

(72) Inventors:

SNIECHOWSKI Hugo José
Rivadia 1030,
(3360) Oberá-Provincia de Misiones,
ARGENTINA

(74) Representative

FISHER CORMACK & BOTHA
P O Box 74
Blantyre
MALAWI

(51) International Classification : A23F 3/12 A23F 3/16
A01F 29/00

(54) Title : .

Tea leaves mincing machine.

(57) Abstract :

A post-cropped tea-leaves mincer (11)includes a blade shaft (17)vertically arranged inside a housing (13)and to which between one and two-hundred blades (19)are affixed. The housing is provided with a predetermined irregular facetting, preferably two facing facets (61)of a different size than the rest (61). Two embodiments of an improved bladeholder (21)are disclosed, respectively provided with three and four blades per plane.

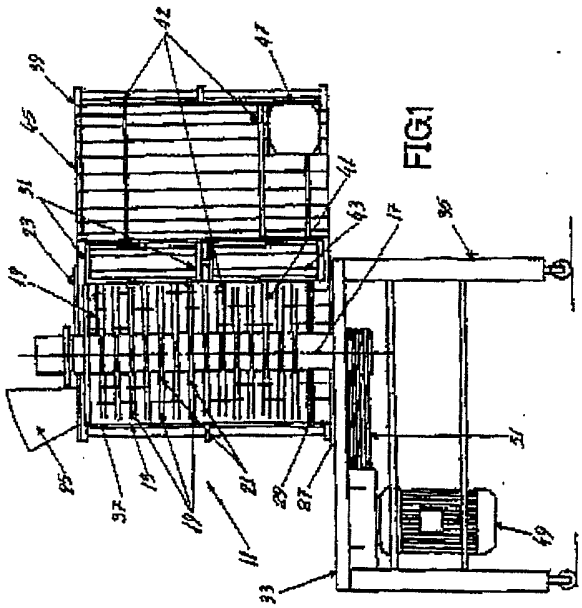

FIG1

(56) Documents Cited : SU 1 077 599 A SU 1 083 964 A

TEA LEAVES MINCING MACHINE

FIELD OF THE INVENTION:

The present invention refers to a tea mincer used in the maceration stage of tea production during which green and withered tea leaves are macerated.

Tea is produced with buds, young leaves, petioles (leaf stalks) and soft stems from the species *Camelia sinensis*. In the tea production industry, and particularly in the context of the present invention, the following is to be understood:

green tea leaf: the buds, young leaves, petioles and soft stems from the *Camelia sinensis* species;

withered tea leaf: the green tea leaves after being subjected to the withering process;

withering: the physical-chemical flexibilization process of green tea leaves consisting in a stagation process of the leaves for a period of 4 to 18 hours during which a certain percentage of water is extracted and the leaves suffers changes in its chemical components and cellular permeability, these chemical changes during the withering process having a determinable effect on the final product quality.

maceration: the action of mincing a mass of green or withered leaves in order to rupture the cellular tissue thereof, thus spilling the juices therein which then mix together;

The use of dry tea-leaf infusion as a beverage has its origin in the old Ages. According to history, tea was first cultivated and the leaves prepared in China. The origins of the te plant are found in and around a fan-shaped area which includes High Burma, southwest China and Assam. In Argentina, tea is grown in the provinces of Misiones and northeast Corrientes.

There are many ways of preparing the tea leaves, but overall it is divided into green or black tea; the former also known as as fermented tea and the latter as unfermented tea. The term "fermentation" is really misused in this case because in the

production of tea there is no fermentation process, rather a process of oxidation.

The leaf is rich in an alkaloid caffeine which can represent up to 4% of the dry matter in the young leaf. It is also rich in poliphenols, which oxidize during the production of black tea and condense to form bodies with tannine properties. The tea's flavour, colour and aroma have a decisive value in the quality of the final product, conditions that depend on any number of factors such as geographic, environmental, genetic material and, significantly, from the production process.

Once cropped, the green leaves are transported to the production plant where, depending on the individual characteristics of each plant, different production processes are carried out. Just for reference, the major production stages of black tea are mentioned hereinafter, however it is to be noted that such are general statements and that each production plant has its own different productions standards.

Withering:

The recently cropped green buds of tea are transported from the plantations and prepared in the production plant in special bins or pans or on special conveyor belts where the withering process is carried out over a variable period from 4 to 18 hours. During this stage, physical-chemical changes take place in the green leaf which materially affect the character of the licqours. During the withering process, water is extracted from the leaf (increasing the permeability thereof), thereby reducing the weight of the leaves in the range of 10 to 35%, depending on variable production factors, one of the more important being the type of mincing machine used on the withered green leaf. During withering, the levels of starch diminish and of sugars increase, protein matter decreases slightly and aminoacids increase.

Maceration:

When the leaf is minced, the breakup of its tissue and cells take splace, initiating the oxidization process of the cell juices, with the aid of an enzime, oxidase, naturally present in the leaf. This is how the process called "fermentation" begins. During the mincing or maceration process, the granularity of the final product is

determined, which is of vital importance according to the use to be given to the final product. Hence, the importance of the mincing machine to produce different granularities according to the different final products required.

Fermenting:

The macerated tea is subjected to a fermenting (oxidation) process, which is the stage in which the products contained in the buds react with each other, forming compounds that convey the tea's special flavour. It is generally carried out on continuos machines, producing the oxidation and condenstaion of the polyphenols. This causes a change in colour, the minced green-colour leaf changes to a copper-orange colour. Also in this process the so-called "essential oils of the tea" are formed, which are aroma generators. All teas have an aroma, but some at certain times of the year posess particular aromas called "*flavours*".

Drying:

The drying carried out in special dryers, at temperatures between 90°C and 103°C, deactivates the enzymes and the end product contains a maximum of 3% of moisture.

BACKGROUND OF THE INVENTION:

The tea industry has been in constant evolution since its beginning. In 1923, a factory in Cachar (north of India) used a tall-grass cutting machine (*Chaff cutter*) to cut the unwithered tea leaves and to be able to curl them better in a later stage. Then, in 1925, a tabacco cutter (*Legg-cutter*) started to be used with success.

In 1932, W. McKercher designed the CTC maching (*crushing-tearing-curling*), carrying out the functions maceration, tearing and curling. It is composed of two engraved metal rolls (of stainless steel) rotating at different speeds, one at 70 r.p.m. and the other at 700 r.p.m..

Another machine used by the tea industry is the *Rotorvane* machine. It comprises a horizontally-arranged worm (endless screw) with vanes that, upon turning, curl the tea by friction over fixed vanes arranged on the cylindrical body. At the end it

has a star-wheel that chokes the tea outlet. Depending on the closed degree of this star-wheel, greater pressure is confered on the tea mass against the rotating vanes thereby increasing the level of cell break-up. It works at low speeds (45 to 50 r.p.m.).

The LTP machine (*Lawrie Tea Processor*) is a tea processor that, essentially, powders the withered leaf. It comprises a horizontally arranged rotor with freely-moving hammers. It operates at 2,100 r.p.m., violently destroying the tea buds and leaves.

All the above-mentioned machines have the following drawbacks:

- High degree of maintenance,
- High costs in energy consumption,
- Increase the temperature of the tea mass through the maceration process, which negatively affects the quality of the final product,
- Difficulty in the cleaning, washing and hygene of the internal components of the machines.

These drawbacks were identified in my Republic of South African patent 98/7315 and Zimbabwe patent 47/98, which provide guidelines for a maceration machine that solve these problems conceptually.

SUMMARY OF THE INVENTION:

After rigorous bench testing in a pilot production, jointly with laboratory analysis of results from different trials and tests, a substantially improved mincing machine has been obtained. The subject-matter of the invention is a mincing machine comprising the following features:

- produces tea of fine granularity, with a high percentage of small particles under 2 mm,
- produces tea with uniform granularity,
- a self-cleaning machine, meaning that its mechanical functionality does not allow production residue to accumulate and contaminate the production process,
- the mincing process is carried out at room temperature and does not increase the

temperature of the mass of tea to levels enough to impair the quality thereof,

- the product resulting from the mincing is in the form curled particles, having a uniform, rounded, flakeless appearance, resulting consequently in a tea of apparent high density.

As mentioned in said Republic of South African patent 98/7315 and Zimbabwe patent 47/98, the main constructive difference with all the conventional types of tea processing machines is the arrangement of a vertical rotary shaft carrying the blades. This shaft is placed inside a facetted housing. The housing has an inlet for loading withered leaves located on the housing's upper lid and an outlet for discharging minced matter located at a tangent at the lower end of the housing. The withered leaves, upon entering under the effect of gravity, continue their path under the effect of the gravity as well as the suction force generated by the blades rotating at high speed.

The vertical shaft supports blade-holder plates, mounted one above the other with a fixed spacing in between and slight phase shift in the vertical direction in such a manner that the blades do not touch the "bananas". (The so-called "bananas" in this document refer to the machine component located in the interior of the housing shaped as a stainless steel rib the function of which is to avoid the free fall of the tea and macerate of the particles that come between the ribs and the blades).

The blades are mounted in groups of three or four on each plate. The leading surface of the blades and the position of the bananas are located and positioned in such a manner as to cut and curl the tea. The slope and position of the blades may be adjusted according to the type of raw material and desired final product.

One of the improvements of the invention is that the housing is built with interior facets with programmed irregularities which were developped in the field of research.

Another of the improvements lies in the design of the blade-holder plates: it being determined during research that the design of the blade-holder plates significantly affects the processing of tea. An improved blade-holder plate was developped which, in an initial embodiment, carried three blades per maceration

horizontal plane, each formed by a pointless triangular plate and wherein two plates are joined together by a collar or cylindrical bracket. In a second embodiment, consisting of blade-holder plates with four elements per horizontal plane, each rim extending radially outwards in the form of four lugs that narrow progressively towards the connection ends of the blades.

BRIEF DESCRIPTION OF THE DRAWINGS:

These and other objects and advantages of the present invention are brought out in the following detailed description, given by way of example of a prefered embodiment of the invention and by no means for restricting the scope thereof, together with the accompanying drawings wherein:

Figure 1 is a general view of the mincer machine according to a prefered embodiment of the invention, illustrated with a pivoted part of the housing open in order to reveal the arrangement inside the machine; and

Figure 2 is a diametral cross-section of the machine of figure 1 showing the dimensions and the operation thereof.

Figure 3 is a magnification of details of the blades and bananas of the machine of figure 1.

Figure 2 is a cross-section of the housing of the machine of figure 1 showing a specific feature of the facetting thereof.

Figure 5A is a plan view of a blade holder for the machine of figure 1 according to a first embodiment whereas figure 5B is a cross section thereof.

Figure 6A is a plan view of a blade holder for the machine of figure 1 according to a second embodiment whereas figure 6B is a cross section thereof.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION:

Refering first to figure 1, a dry tea leaves mincer **11** is shown according to the present invention. The mincer **11** comprises a housing **13** within which a rotary shaft **17** is vertically mounted and to which multiple blades **19** are attached by means of bladeholder plates **21** defining a plurality of planes of operation. The housing **13** has a

diameter ***d*** of 62 cm and a height ***h*** of 1 m, thereby providing a capacity in excess of 3 m^3, enough to house between one- and two-hundred blades **19**, which may vary for different leaf varieties.

The housing **13** has a fixed lid **23** featuring an eccentric vertical opening **25** for loading the tea leaves to be minced. This inlet **25** may include a shute or some sort of vertical duct for the cropped tea-leaves to be able to decant towards the inlet under the effect of gravity forces. The bottom comprises a base **27** with holes in it for allowing air driven by a disk **29** affixed to the rotary shaft **17** to flow therethrough.

Inside **41** the housing there is a number of stainless-steel bananas **42** arranged in alternate fashion. The bananas **42** extend horizontalally, fixed against the housing wall and vertically separated by a gauged distance, of about 3 mm for example, from the plane of rotation of a respective set of blades **17**, with which it interacts according to the present invention to carry out leaf cutting, macerating and curling operations in order to mince the leaves down into curled bits to promote fermentation (oxidation) and withering in later stages.

The entire housing body **13** may be made of metal, such as stainless steel for example, and comprise two housing halves **37** and **39** which complement each other and form an interior **41** substancially closed by the lid **23** and the base **27**. Three bananas **42** are mounted in alternate fashion in the interior **41** of the housing. One of the housing halves **37** is fixed, soldered to the lid **23** and to the base **27**. Alternatively, the housing **13** may be made of plastics, in which case the fixed housing part **37**, the lid **23** and the base **27** may be molded as a single piece.

The other housing half **39** is pivotal, joined to the fixed housing part **37** by a hinge mechanism **31** between one of their common edges **43**. The pivoted housing half **39** enables opening the mincer **11** - when it is out of service - like a door to access the interior **41** of the housing **13** for cleaning and/or maintenance, the latter in particular for sharpening, repairing and changing the blades **19**. In order to provide a wider opening and more space for carrying out these jobs, a part **45** of the lid **27** may be integrated into the door **39**. The bottom part of this door **39** is formed with a round

outlet opening **47** arranged at a tangent for discharging the minced leaf bits from the interior **41** of the housing **13**. In use, the door **39** is of course closed and latched to the fixed housing part **37** by means of a conventional locking device (not illustrated).

The mechanical power for mincing the tea-leaves is provided by a conventional electric motor **49**, of between 40 and 50 HP, coupled to the lower end of the blade shaft **17** by means of a pulley-and-belt system **51**. This power transmission system **51** is housed underneath the table **35**, such that the blade shaft **17** passes through the board **33**. The motor **49** may be mounted beneath the table **35** by means of a support **53** secured to the underface of the board **33**. Naturally, as an alternative, it is possible to rest the motor **49** on top of the table **35**, such that both the shaft of the motor **49** and the blade shaft **17** pass through the board **33**.

Figure 2 schematically shows the locus ***X*** of the tea product as it travels through the mincer **11**. The shaft 17 is rotated at between 2,300 and 2,700 r.p.m. by the motor **49**. The cropped leaves enter into the mincer **11** through the upper opening **25** and fall into the interior **41** under the effect of gravity, as indicated by arrow *E*. Once in the interior **41** of the mincer **11**, the leaves continue falling under the gravitational effect to come under the mincing action of the blades **19** turning at the same speed as the shaft **17**, the leaves travelling now along a generally helicoidal locus ***X***, before being discharged through the lower opening **47**, as indicated by arrow *S*, in the form of bits of leaves of generally uniform size.

The fact that the blades **19** are fixed (not loose as in conventional machines) and the free gravitational conveyance (that is, unforced) of the leaves generates heat by friction but of an overall magnitude which is less than in the known prior art. The effect of the lower generated heat is reduced further by a greater flow of ambient air - following a locus *E-X-S* similar to the product - such that both phenomena converge to subdue the excess-temperature problem which accelerated the withering and qualitative deterioration of the tea-leaves.

Furthermore, the fixed mounting of the blades **19** to the bladeholder plates **21** is necessary for the former to properly mince the leaves against the bananas,

curling them also. Figure 3 shows a particular shape of the blades **19** and the bananas **42**. Each blade is provided with a work-surface shaped with a slanted, initially flat, leading length **55a** joined by means of a curved length **55b** to a generally horizontal maceration length **55c**. Likewise, each banana **42** has a work-surface formed by a slanted leading length **57a** joined to a generally horizontal maceration length **57c** by means of a curved length **57b**. The spacing ***s*** between the planes of the facing maceration surfaces **55c-57c** belonging to the banana **42** and the blade **19** is gauged to about 3 mm, which may be adjusted according to the type of leaf. Furthermore, the maceration surfaces **57c** of the banana **42** are provided with solder supplements **59** which aid in macerating and curling the processed leaves.

The leaf reaches the gap between the leader surfaces **55a-57a** of a banana **42** and blade **19** pair where it is dragged into the gauged gap between the facing maceration surfaces **55c-57c**. The leaf arrives in a random position, meaning that different parts thereof contact the surfaces **55c-57c** of the banana **42** and the blade **19**, thereby promoting a scraping movement that macerates and curls the leaf.

The housing **13** is cylindered with facets as illustrated in figure 4, forming 36 facets **61** around its lateral circunference, which may be done by means of a plate folding machine. It has been found that a certain facetting of the inner surface of the cylindrical wall of the housing **13** improves the mincing. In the present exemplary embodiment, each faced side is about 53 mm wide.

However, suprisingly it has been determined that the maceration action may be improved by providing irregular facets. This was done by making that the sides of two diametrically facing facets **61´** only 44 mm wide, whereas the remaining thirty-four facets had the aforesaid 53 mm width.

Both the plates and blades individually as well as their distribution around the shaft **17** of the machine must be carefully balanced. Two preferred embodiments are hereinafter disclosed according to the type of tea-leaf. In both cases, the bladeholder plates **21** are laser cut and profiled in order to satisfy the narrow tolerances imposed by the required balance.

Figures 5A and 5B illustrate a suggested embodiment for the bladeholder assembly **21** for the illustrated mincing machine. The assembly **21** comprises two or more, preferably about ten or twenty, bladeholder plates **21A**, made of 8 mm thick steel plated, fixed by means of a spacer **63** at predetermined 37 mm intervals alog the shaft **17**. The spacer **63** is a cylindrical sleeve having a 178 mm internal diameter and a prisoner **65** in its side to affix the assembly **21** to the shaft. Each bladeholder plate is shaped as a triangular plate **21A**, the three vertices of which are cut off at a radius of 210 mm and provided with 11 mm diameter orifices **67** on a 185 mm radius for assemblying its respective three blades **19** distributed at 120° from each other. In each pair of plates **21A**, the successive plates are circularly 60° out of phase.

Figures 6A and 6B illustrate an alternative embodiment of the bladeholder assembly for the mincing machine of the invention. Each bladeholder plate **21B** is shaped with four fingers **69** radially extending outwards at 90° from one another and progressively narrowig towards the end holding the respective blade **19** whereas the successive plates **21B** are 45° out of phase on the spacer sleeve 63.

An embodiment of the invention has been disclosed herein by way of example, although it is foreseeable that persons knowledgeable in the art may eventually devise changes and variations on the specification without departing from the spirit and purview of the invention.

CLAIMS

1. A mincer of green and withered tea leaves for making fermented or partly fermented black tea or unfermented green tea, which comprises a housing having an internally facetted wall and wherein there is a rotary shaft arranged in a generally vertical position and provided with blades arranged in a plurality of planes of operation and, furthermore, a plurality of bananas affixed to the interior of the housing and vertically out of phase in relation to at least some of said blade operation planes, characterised in that said blades are each provided with a work-surface shaped to provide an inclined leader length which continues in a generally horizontal mincing length whereas, to match, each of said bananas is provided with a work-surface shaped to provide an inclined leader length which continues in a generally horizontal mincing length, wherein said leader spans point in respective directions against the relative movement between said bananas and blades.
2. A mincer according to claim 1, characterised in that said mincing spans are separated by a distance of about 3 mm between corresponding blades and bananas.
3. A mincer according to claim 1 or 2, characterised in that the surface of the mincing spans of said bananas are rough.
4. A mincer according to one of the preceding claims, characterised in that the facetting is irregular.
5. A mincer according to claim 4, characterised in that said facetting comprises a series of substantially like facets followed by a different facet.
6. A mincer according to claim 5, characterised in that each different facet is about 20% narrower than said like facets of the housing.
7. A mincer according to claim 5 or 6, characterised in that there are two such different facets diametrically opposite one another.
8. A mincer according to claim 5, 6 or 7, characterised in that said bananas alternate inside said housing and said different facets are in correspondence with the termination of alternate bananas.

9. A mincer according to one of the preceding claims, characterised in that said housing is made from a plate which is facetted by means of a folding machine.

10. A mincer according to one of the preceding claims, characterised in that said plurality of blades are affixed to respective bladeholder plates, each holding three blades separated 120° from one another, each bladeholder plate shaped as a triangular plate, said plates being attached to said shaft at predetermined intervals along said shaft, succesive blades being at about 60° out of phase from one another on said shaft.

11. A mincer according to one of the claims 1 to 9, characterised in that said plurality of blades are affixed to respective bladeholder plates, each holding four blades separated 90° from one another, each bladeholder plate shaped shaped with four radial projections which progressively narrow towards the respective blade attachment end, said plates being attached to said shaft at predetermined intervals along said shaft and such that succesive blades are at about 45° out of phase from one another on said shaft.

12. A bladeholder plate for affixing a plurality of blades, characterised in that said plate is shaped as a equilateral triangular plate, each vertex of which holds a respective blade such that the three blades affixed to said plate are separated substantially 120° from one another.

13. A bladeholder plate for affixing a plurality of blades, characterised in that said plate is shaped with four radial projections which progressively narrow towards a respective end to which a respective blade is attached such that adjacent blades affixed to said plate are at right angles to one another.

14. A housing for a mincer of green and withered tea leaves for making fermented or partly fermented black tea or unfermented green tea, said housing having an internally facetted wall and containing a rotary shaft arranged in a generally vertical position and provided with blades arranged in a plurality of planes of operation and, furthermore, a plurality of bananas affixed to the interior of the housing and vertically out of phase in relation to at least some of said blade operation planes.

characterised in that the facetting of the housing wall is predeterminedly irregular.

15. A housing according to claim 14, characterised in that said facetting comprises a series of substantially like facets followed by a different facet.

16. A housing according to claim 15, characterised in that each different facet is about 20% narrower than said like facets of the housing.

17. A housing according to claim 15 or 16, characterised in that there are only two such different facets diametrically opposite one another.

18. A housing according to claim 15, 16 or 17, characterised in that said bananas alternate inside said housing and said different facets are in correspondence with the termination of alternate bananas.

19. A housing according to any one of the claims 14 to 18, characterised in that said housing is made from a plate which is facetted by means of a folding machine.

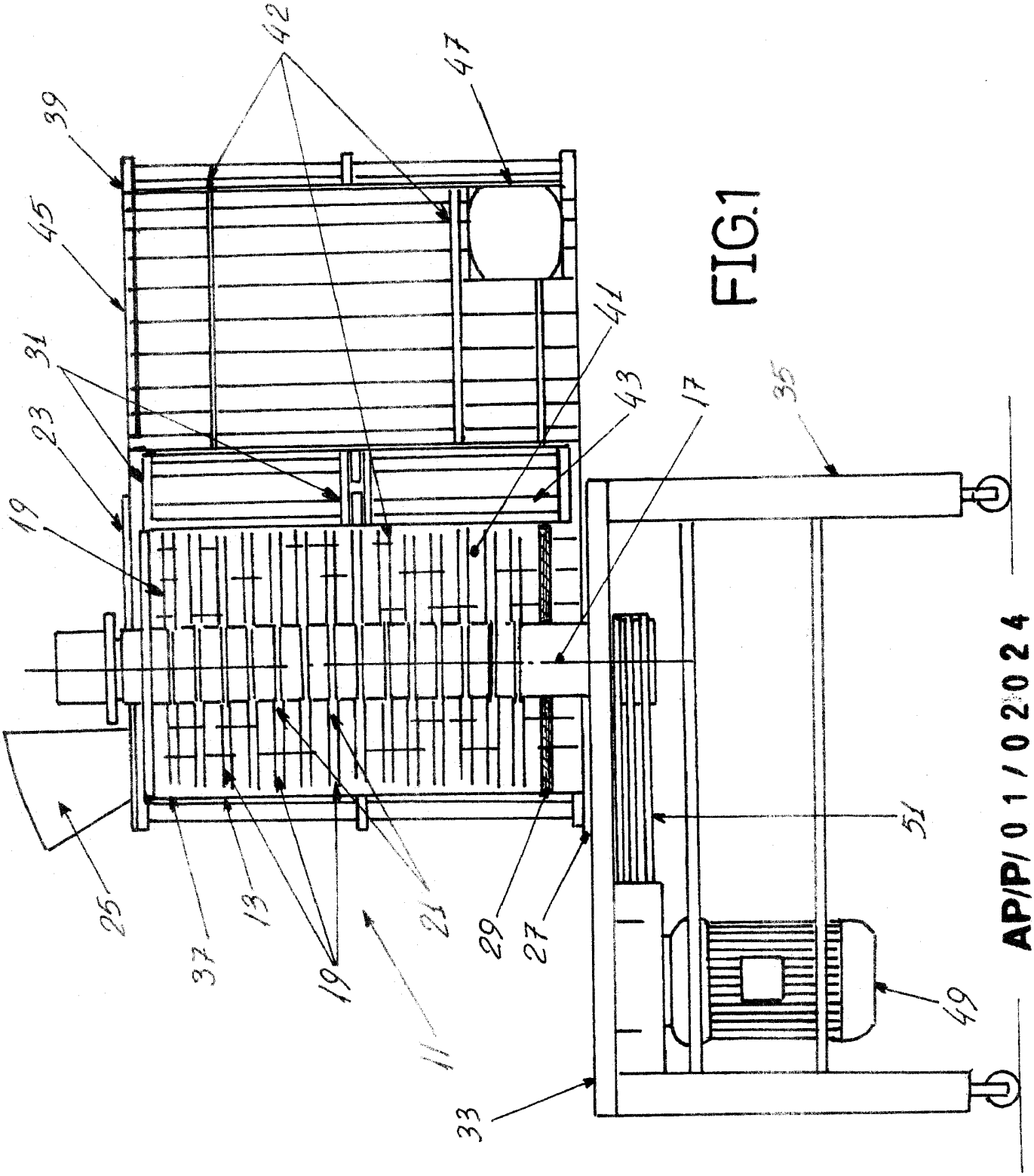

FIG.1

AP/P/01/02024

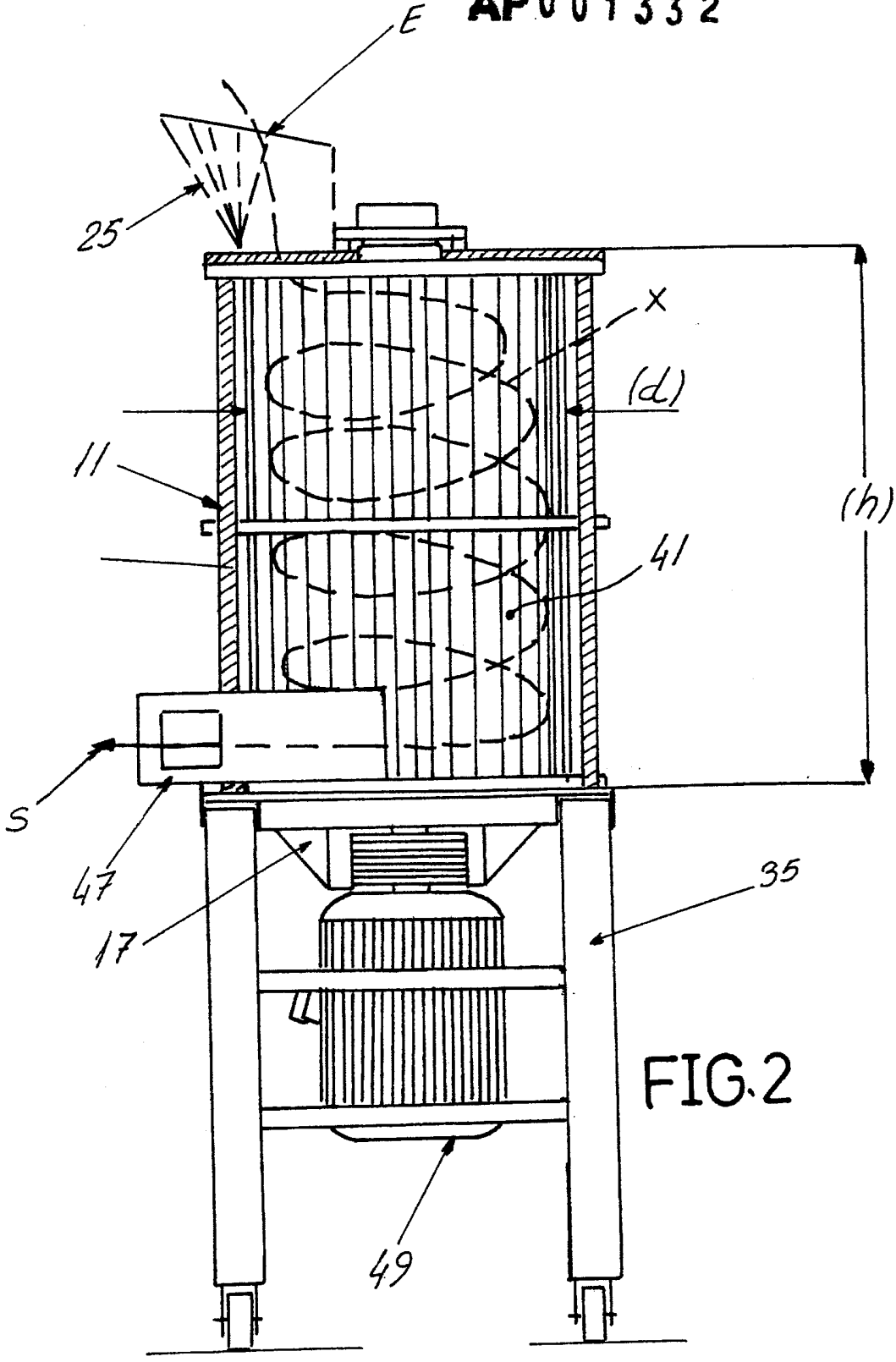

FIG.2

AP/P/01/02024