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Asfour

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[54] **METHOD OF AND APPARATUS FOR SORTING TOBACCO LEAVES**

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[52] **U.S. Cl.**..... **209/75,** 131/146, 131/149, 209/111.6

[51] **Int. Cl.**..... **B07c 5/342**

[58] **Field of Search**..... 209/75, 73, 111.6; 131/138, 131, 110, 84 B, 146, 149, 21 B, 21 R

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[57] **ABSTRACT**

Apparatus for sorting leaves, particularly tobacco leaves, has a vibrating type conveyor provided with successive surfaces of different inclination to separate the leaves in the longitudinal direction of their motion. After separation the leaves are passed through a sorting station which separates foreign bodies. The leaves are then passed to a sorting station where they are classified, by an optical device according to color differences.

11 Claims, 6 Drawing Figures

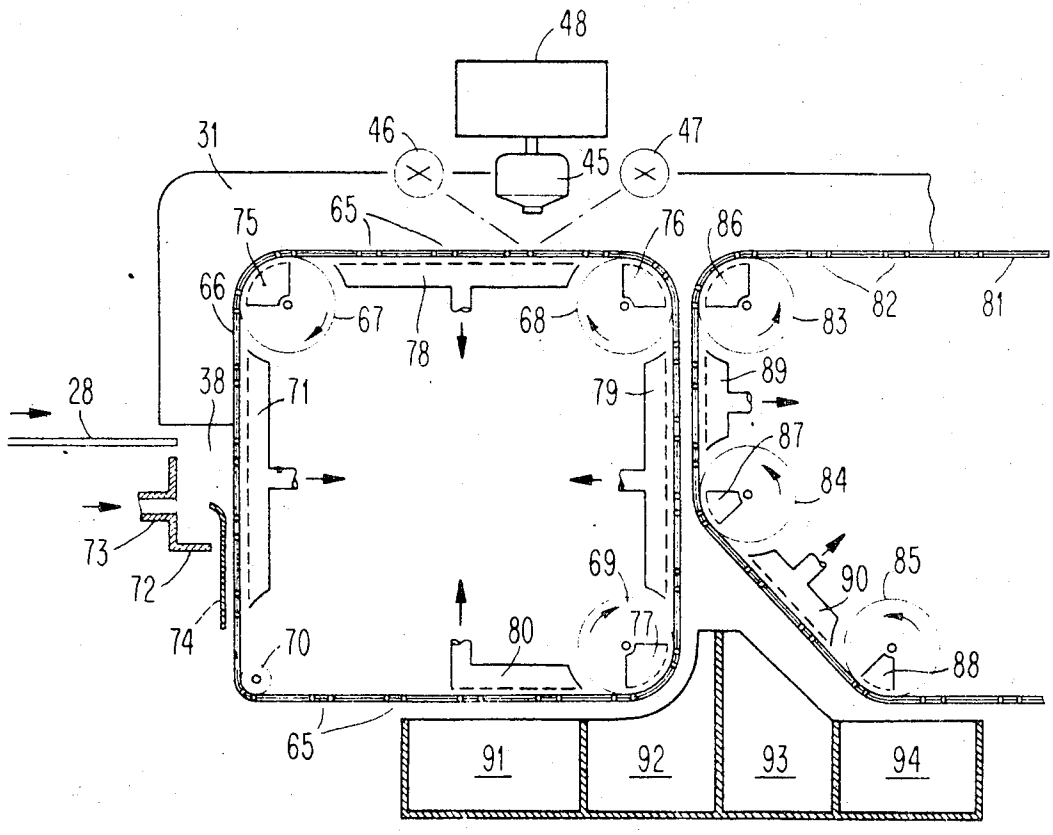
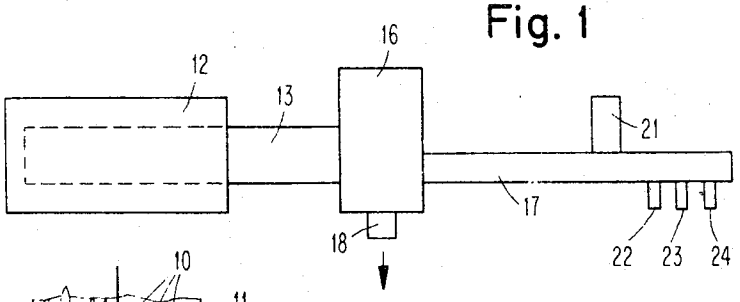


Fig. 1



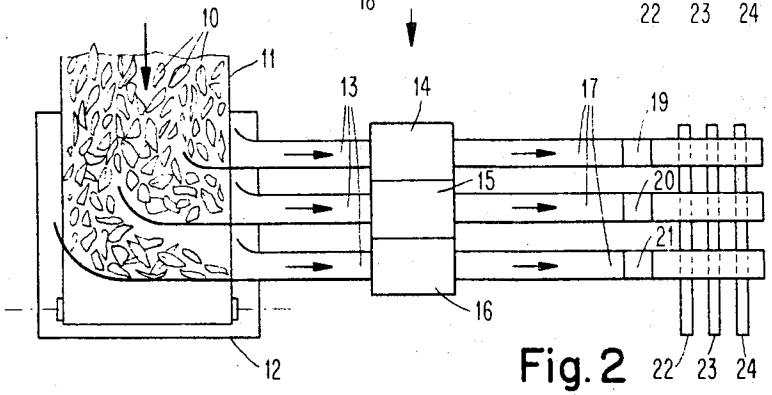


Fig. 2

Fig. 3

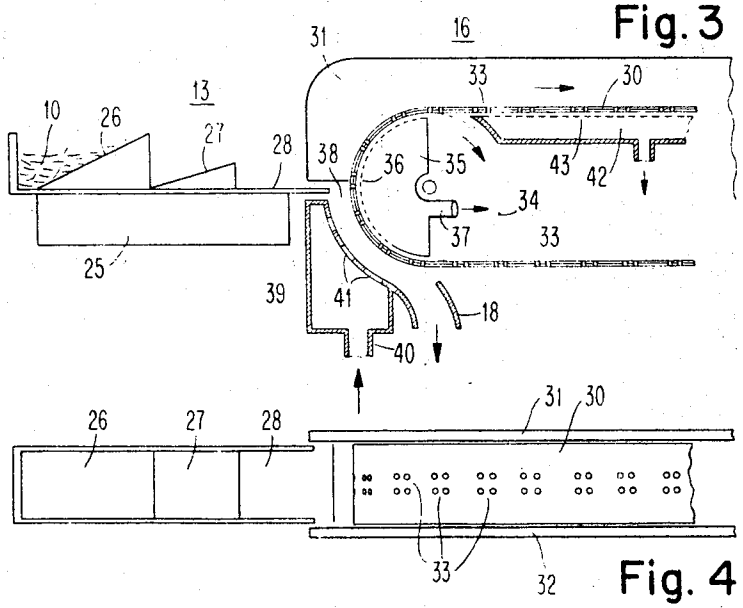


Fig. 4

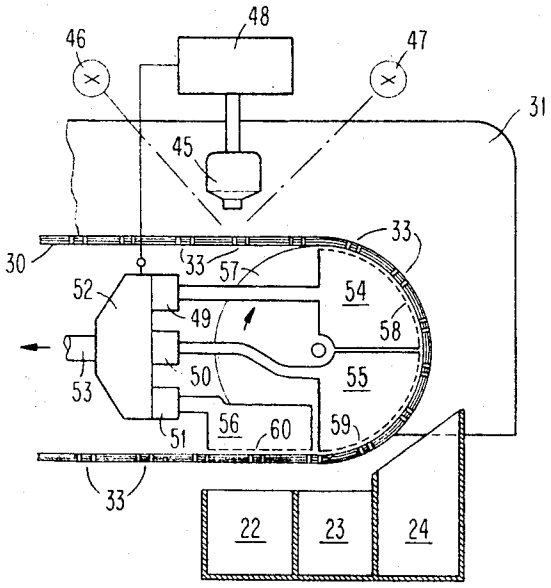

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Fig. 5

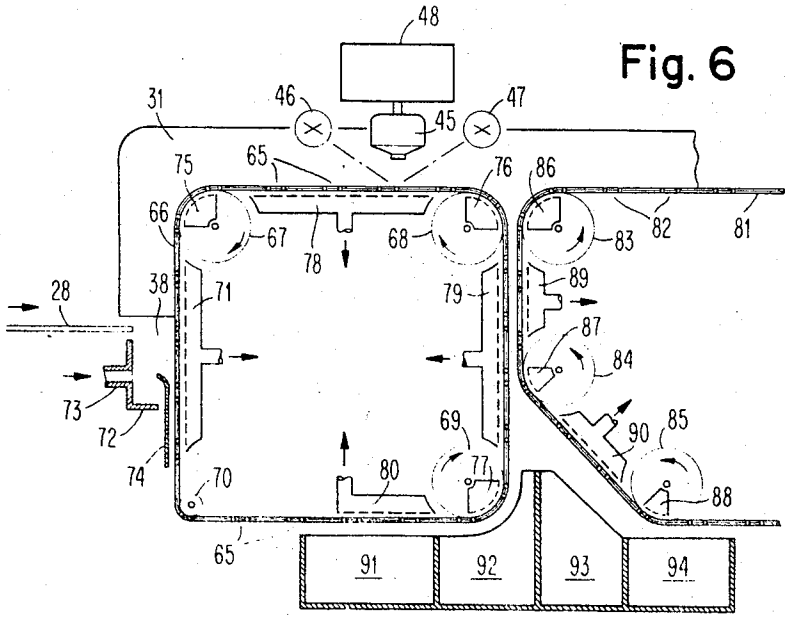
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Fig. 6

METHOD OF AND APPARATUS FOR SORTING TOBACCO LEAVES

The present invention relates to a method of sorting leaves and similar material, more particularly tobacco leaves, and to a sorting apparatus therefor.

In the tobacco processing industry it has so far been common manually to sort the tobacco leaves supplied in terms of quality, particularly as to their colour. The leaf material is spread on conveyor belts and passes through a number of sorting stations where skilled operators check the colour and manually sort out unsuitable leaves and the unavoidable foreign bodies. This qualitative sorting is time-consuming and costly; on the other hand, it is also inaccurate since there exists no objective criterion for the colour of the leaves and it is left to the operators to eliminate unsuitable leaves. In addition, distinction in this manner made only between good and poor leaves and the classification of the leaf material into different quality groups, by way of example of different colours, is difficult and uncertain just as the provision of blends of certain amounts of different quality groups.

The present invention eliminates these difficulties and relates to a method of sorting leaves and similar material, more particularly tobacco leaves, and is characterized by the fact that the leaf material to be sorted is separated into a number of parallel channels, moved in the longitudinal direction therein, spread out and subsequently supplied to a first sorting station at the entrance of which individual leaves are gripped and passed along on the one hand and, on the other, foreign bodies extracted, whereupon the individual leaves are supplied, in the parallel channels, to second sorting stations where they are examined in respect of their quality, appropriated to different quality classes and supplied to corresponding sorting channels.

This invention further relates to a sorting apparatus for the performance of the said method characterized by a separating device into parallel channels of which each is provided with a spreading unit for the leaf material in the longitudinal direction and a subsequent first sorting station with a conveyor belt equipped for gripping individual leaves and a separating device for foreign bodies, and by second sorting stations with an examining member for the quality of the various leaves and a signalling unit controlled by the testing member which indicates the quality class to actuate a classifying device for the leaves.

An embodiment of this invention of a suitable sorting apparatus will now be described in greater detail with reference to the drawing with FIGS. **1** through **6** in which

FIGS. **1** and **2** show a side view and, respectively, a plan view of the basic diagram of a sorting apparatus according to this invention;

FIGS. **3** and **4** are an elevation and, respectively, plan view of an embodiment of a spreading device for the leaf material and an embodiment of a pneumatically operating first sorting station of which only the portion associated with one of the parallel channels is represented;

FIG. **5** is an elevation in a diagrammatic view of a pneumatically operating second sorting station which is designed, by way of example, for three different sorting channels, and

FIG. **6** is an elevation of second embodiment of the first and second sorting stations.

According to the present method, the leaves or similar material, particularly tobacco leaves, are sorted in the manner subsequently described in greater detail with reference to FIGS. **1** and **2**. The leaf material **10** is, by way of example, supplied to a separating device **12** via a conveyor belt **11** or a chute where it is divided into a number of channels **13** disposed in parallel in which it is moved in the longitudinal direction and thereby spread in the same direction. The spreading must be effected in such a manner that the leaf material in each of the channels reaches the sorting stations **14, 15, 16** arranged at the end of each channel **13** if possible in only one layer and without mutual overlapping of the leaves. The number of parallel channels **13** may be increased at will and is so selected that the entire quantity of the leaf material **10** supplied is passed on.

Gripped in each of the first sorting stations **14, 15, 16** is only a single leaf of the spread leaf material supplied and then passed on along the subsequent channel **17**. At the same time, possible foreign bodies are there eliminated and removed through the outlets **18**.

The individual leaves moved in the channels **17** pass into second sorting stations **19, 20, 21** where they are examined in respect of their quality, appropriated to various quality classes and passed, depending on their quality class, into a corresponding separate sorting channel **22, 23, 24**. In sorting tobacco leaves the second sorting stations **19, 20, 21** are by way of example equipped with a testing member for the colour of the individual leaves and a signalling member controlled by the testing member and indicating the colour class for the actuation of the classifying device for the leaves. The signalling member may also be so designed that e.g. two colour classes pass into the same sorting channel.

In a preferred embodiment of the sorting apparatus the spreading device in the channels **13** consists of a vibrating conveyor diagrammatically indicated in FIGS. **3** and **4**. Such vibrating conveyors are known and comprise, by way of example, a motor driven vibrating table **25** with a flat top side provided with three conveyor sections **26, 27** and **28** for each of the channels **13**. In operation the leaf material **10** on the steepest conveyor section **26** passes into the less steep conveyor section **27** at a certain adjustable rate where it rises more rapidly in accordance with the lesser gradient of the surface and is then moved into the conveyor section **28** at the greatest speed. This ensures that the leaf material is supplied to the first sorting stations **14, 15, 16** spread in the longitudinal direction and virtually in a single position only. Leaves possibly located on the lateral separating walls of the channels **13** are caused to drop into the adjacent channels **13** by the vibrations. Vibrating conveyors having more than three conveying sections or spreading devices of some other type may naturally be employed if it is ensured that the leaf material is supplied to the first sorting stations **14, 15, 16** as evenly as possible in one position only.

FIGS. **3** and **4** show an embodiment of the design of the first sorting station **16** using a pneumatic separating device for the foreign bodies. The conveyor belt **30** indicated together with its lateral walls **31, 32** forms one of the parallel channels **17** (FIG. **2**). This conveyor belt **30** consists of a material impermeable to air but is provided with successive groups **33** of e.g. four holes each, the groups **33** being spaced from one another by an amount which is preferably somewhat longer than one

of the leaves to be conveyed. The conveyor belt **30** passes over a drum **34** with a shell permeable to air in the front half of which a hollow body **35** is arranged of which the shell surface **36** is perforated and from which air is removed by suction through the line **37.** Accordingly air is sucked through each of the groups of holes **33** as long as it passes over the drum **34** in the range of the perforated front end **36** of the hollow body **35.** Located at the inlet of this first sorting station **16** and moved forward on the conveyor plate **28** is the spread leaf material which then passes to the gap **38** between the conveyor plate **28** and the conveyor belt **30** moving around the drum **34.** A leaf is picked up by the individual groups of holes **33** passing through this gap **38** in the upward direction and held by the suction of these holes until the group of holes involved leaves the area of the hollow body **35** at the upper end whereupon the leaves remain in their position on the conveyor belt **30** which continues to move horizontally. Arranged underneath the slot **38** is a hollow body **39** which may, if desired, be connected to a compressed-air line via the connection **40** and which has its curved side facing the drom **34** provided with air slots **41.** An air current may thus be created through these air slots in the upward direction towards the slot **38** which prevents the leaf material supplied to the gap **38** from dropping down into the channel between the drum **34** and the hollow body **39.** However, the air current is so adjusted that foreign bodies supplied to the gap **38** along with the leaf material can pass through the channel and be removed through the outlet **18.** In sorting tobacco leaves the foreign bodies are commonly pieces of wood, twigs, stones or similar bodies which are substantially heavier than the tobacco leaves to be held by the groups of holes **33** so that complete removal of such foreign bodies is ensured if the air current through the air slots **41** is properly adjusted. The air current may also be dispensed with altogether, particularly if the leaf material is light.

Mention is also made of the fact that the rate of revolutions of the drum **34** and thus the speed of the conveyor belt **30** should naturally be so adjusted that the leaf material arriving by the conveyor plate **28** is completely removed. The hollow body **35** may also be subdivided into several sectors which can selectively be connected to the lines **37.** If desired, the hollow body **35** may also be subdivided by an adjustable transverse partition in order that the perforated wall **36** sucks in air through the passing groups of holes **33** only in the upper angular section.

In order to fix the individual leaves located on the conveyor belt **30,** which is of advantage at elevated speeds, a hollow body **42** with a perforated wall **43** can be provided below the horizontal portion of the conveyor belt **30,** connected to an underpressure line and air be sucked up via the passing groups of holes **33.**

The leaves resting on the various conveyor belts **30** pass into second sorting stations **19, 20, 21** of which an embodiment is shown diagrammatically in FIG. **5** and which operates with a pneumatically actuated classifying device. Provided in this second sorting device is a testing member **45** which determines the colour of the tobacco leaves illuminated by the light sources **46** and **47.** Such optical testing devices selectively responding to the colour of such leaves are known so that a more detailed description can be dispensed with. The testing member **45** operates with a signalling device **48** which is so designed that it supplies different signals depending on the colour of the leaf on the conveyor belt **30** just passing under the testing member **45.** These electrical signals actuate the valves **49, 50, 51** of a pneumatic calssifying device which here causes appropriation of the tested leaves to the three sorting channels **22, 23, 24** which extend over all conveyor belts **30** of the parallel channels **17** (FIG. **2**). The pneumatic classifying device is connected, via the tube **53,** to an air pump, and the distributor **52** with the valves **49, 50, 51** enables underpressure to be produced in the hollow bodies **54, 55,** and **56** as required. These hollow bodies have their sides facing the drum **57** provided with a perforated wall **58, 59, 60** so that air is sucked up via the groups of holes **33** as they pass by the perforated walls **58, 59, 60** and the associated hollow bodies **54, 55** and **56** are under a pressure below atmospheric.

If, by way of example, a leaf passes under the testing member **45** of which the colour corresponds to the quality class assigned to the sorting channel **24,** the signalling unit **48** will open the valve **49** alone while the valves **50** and **51** remain closed so that underpressure is created in the hollow body **54** only. The leaf in question is then held on the group of holes **33** on which it rests as soon as this group of holes reaches the area of the perforated wall **58** of the hollow body **54,** and drops from the said group of holes as soon as the latter passes within the range of the perforated wall **59** of the hollow body **55.** The leaf then drops as predetermined into the sorting channel **24** assigned to the quality class contemplated.

However, if a leaf passes the testing member **45** which owing to its colour belongs in the quality class of the sorting channel **23,** the signalling unit **48** will open both valves **49** and **50** while the valve **51** remains closed. The leaf resting on a group of holes is in this case held as it passes the ranges of the perforated walls **58** and **59** and released only then and thus drops into the contemplated sorting channel **23.**

A leaf belonging in the quality class of the sorting channel **22** is held, after passing the testing member **45** and opening of all three valves **49, 50, 51** by the signalling member **48,** throughout its passage over the perforated walls **58, 59, 60** and therefore drops into the sorting channel **22.**

If desired, the signalling member **48** may naturally be so adjusted that the leaves of the said three quality classes are subdivided among only two sorting channels so that a blend of two quality classes is produced in one of the sorting channels.

In order to obtain data as to how many leaves of the various quality classes are present in the leaf material, the signalling member **48** may be provided with a counter for each quality class which responds when a leaf belonging in the said quality class passes under the testing member **45.**

Another embodiment of the first and second sorting stations per channel **13** and, respectively, **17** is shown in FIG. **6.** The leaf material moved in the direction of the arrow on the conveyor plate **28** passes to the gap **38** where it is separated from foreign bodies if any. Passing this gap **38** is the conveyor belt **66** impermeable to air but equipped with groups of holes **65** which is guided by the drums **67, 68, 69** provided with a shell permeable to air. The hollow body **71** continuously connected to an underpressure system which is provided with a perforated wall facing the conveyor belt

66 ensures that the groups of holes 65 passing by this wall engage individual leaves in the gap 38, hold them and that the leaves are then conveyed upwards by the conveyor belt 66. Arranged below the gap 38 is an intercepting device 72 for the foreign bodies falling in the gap 38, the connection 73 of the said device enabling an air current to be produced in the upward direction through the gap 38 if so desired. A plate 74 movable in the direction towards the gap 38 and impermeable to air enables the catchment point of the individual leaves by the groups of holes 65 in the conveyor belt 66 to be adjusted. Arranged within the drums 67, 68 and 69 are sector-type hollow bodies 75, 76, and 77 of which each is provided with a perforated shell and can be connected to the underpressure system in accordance with the hollow body 35 previously described with reference to FIG. 3. Also provided are the flat hollow bodies 78, 79 and 80 of which the wall facing the conveyor belt 66 is perforated and which can also be connected to the underpressure system. While the hollow bodies 71, 75, 78 and 76 are permanently connected to the underpressure system, connection of the hollow bodies 79, 77 and 80 to this underpressure system is effected by valves controlled by the signalling member 48 similar to the valves 49, 50. 51 above described with reference to FIG. 5. The signalling member 48 in its turn is controlled by the testing member 45 so as to determine the quality classes of the individual leaves passing underneath it.

Arranged opposite th endless conveyor belt 66 running downwards is a further conveyor belt 81 provided with groups of holes 82 as the conveyor belt 66 and running over the drums 83, 84 and 85 which are provided, similarly to the drums 67, 68 and 69, with a shell impermeable to air. Provided in the drums 83, 84, 85 are sector-type hollow bodies 86, 87, 88 with perforated shells facing the conveyor belt 81. These hollow bodies 86, 87, 88 may be connected to the underpressure system via valves. In addition, the two hollow bodies 89, 90 are provided which possess a perforated wall facing the conveyor belt 81 and can also be connected to the underpressure system by means of valves.

The classification system is here equipped with four sorting channels 91, 92, 93 and 94. By way of example, if a leaf falling into the quality class of the sorting channel 91 passes under the testing member 45, the underpressure valves for the hollow bodies 79, 77 and 80 are opened by the signalling member 48 so that the leaf involved is held by suction by its group of holes 65 until it is located above the sorting channel 91 into which it is dropped. On the other hand, if the leaf passing the testing member 45 is of the quality class corresponding to the sorting channel 92, the signalling member 48 opens the underpressure valves of the hollow bodies 79 and 77 only which causes the leaf to drop into the sorting channel 92. However, if a leaf of the quality class corresponding to the sorting channel 93 passes under the testing member 45. The underpressure valves of the hollow bodies 79, 77 and 80 remain closed but the signalling member 48 opens the underpressure valves for the hollow bodies 86, 89, 87 and 90 and the leaf involved is held by suction, when its group of holes 65 leaves the range of the hollow body 76, by a corresponding group of holes 82 of the conveyor belt 81, thus being taken over and passed downwards until it drops into the sorting channel 93 after passing the perforated wall of the hollow body 90. For a leaf corresponding to the quality class of the sorting channel 94 the process is the same but the signalling member 48 will also open the underpressure valve of the hollow body 88 so that the leaf is held by the conveyor belt 81 until the sorting channel 94 is reached into which the leaf will then drop.

The designs described above with reference to FIGS. 3 through 6 for the first and second sorting stations are naturally only embodiments and any other suitable design of pneumatic, mechanical or other sorting devices may be employed.

What we claim is:

1. A sorting apparatus for sorting leaves and similar material, more particularly tobacco leaves, characterized by a separating device having parallel channels each provided with a spreading device for the leaf material in the longitudinal direction, by a subsequent first sorting station with a conveyor belt designed to hold individual leaves and a separating unit for foreign bodies, and by a second sorting station along said conveyor belt with a testing member for the quality of the individual leaves and a signalling member controlled by the testing member which actuates classification device for the leaves, said spreading device comprising a vibrating conveyor having several conveyor surfaces rising in the direction of movement, the steepness of the said conveyor surfaces decreasing in successive conveyor sections, and a last conveying section with a substantially horizontal conveyor surface, and including a common vibrator for all said conveyor surfaces.

2. A sorting apparatus for sorting leaves and similar material, more particularly tobacco leaves, characterized by a separating device having parallel channels each provided with a spreading device for the leaf material in the longitudinal direction, by a subsequent first sorting station with a conveyor belt designed to hold individual leaves and a separating unit for foreign bodies, and by a second sorting station along said conveyor belt with a testing member for the quality of the individual leaves and a signalling member controlled by the testing member which actuates classification device for the leaves, said conveyor belt per channel being made of a material impermeable to air and provided with perforations grouped into clusters which are arranged in spaced relationship along the conveyor belt, the spaces being somewhat larger than the leaves to be held, the said conveyor belt passing around a rotating drum at the entrance of the channel involved, the said drum having a shell which is permeable to air and of which the half facing the entrance accommodates a hollow body with a perforated shell and a connecting line for an underpressure system.

3. A sorting apparatus according to claim 2 characterized by a subdivision of the hollow body into a plurality of sectors of which each can be connected to an underpressure system independently of the others.

4. A sorting apparatus according to claim 2 characterized by a radially arranged adjustable partition arranged in the hollow body, the said partition subdividing the same into an upper and a lower hollow space of which only the upper one can be connected to an underpressure system.

5. A sorting apparatus according to claim 2 characterized by a classification device which can be actuated by the signalling device and which comprises a rotating drum around which the conveyor belt passes in a loop of approximately 180° of angle, the said drum having

a shell permeable to air, by two sector-type hollow bodies arranged inside the drum and provided with perforated shell surfaces facing the conveyor belt, of which hollow bodies each can be connected, via a line and an electrically operable valve, to a further flat hollow body which has a perforated wall facing the conveyor belt running off the drum and can be connectd to the underpressure system via the electrically operable valve, by control circuits between the valves and the signalling device, and by sorting channels arranged underneath this classification device, the said sorting channels extending transversely over all classification devices of the individual parallel channels.

6. A sorting apparatus according to claim **5** characterized by the fact that the signalling device and the control circuits to the valves are so designed that the appearance of a signal corresponding to the quality class of the first sorting channel causes the valve for the upper sector-type hollow body to open, that the appearance of a signal corresponding to the quality class of the second sorting channel causes the valves of the two sector-type hollow bodies to open, and that the appearance of a signal corresponding to the quality class of the third sorting channel causes the valves of the two sector-type hollow bodies and the flat hollow body to open, which results in that the leaves located on each group of holes in the conveyor belt are held by suction only while the group of holes involved passes through the range of the perforated walls of those hollow bodies of which the valves are open and then drop into the sorting channels which are located underneath.

7. A sorting apparatus for sorting leaves and similar material, more particularly tobacco leaves, characterized by a separating device having parallel channels each provided with a spreading device for the leaf material in the longitudinal direction, by a subsequent first sorting station with a conveyor belt designed to hold individual leaves and a separating unit for foreign bodies, and by a second sorting station along said conveyor belt with a testing member for the quality of the individual leaves and a signalling member controlled by the testing member which actuates classification device for the leaves, said separating unit for foreign bodies comprising a gap downstream of the last conveyor surface of the spreading device which is passed by the conveyor belt in the upward direction, and a catching device arranged underneath the gap to accommodate the foreign bodies dropping through the gap.

8. A sorting apparatus according to claim **7** characterized by a hollow body arranged underneath the gap, the said hollow body having an adjustable connection to a compressed-air system so designed that an air current of adjustable force can be obtained in the upward direction through the gap.

9. A sorting apparatus according to claim **7** characterized by a plate located underneath the gap which causes the conveyor belt to be shielded and of which the distance from the gap is adjustable.

10. A sorting apparatus for sorting leaves and similar material, more particularly tobacco leaves, characterized by a separating device having parallel channels each provided with a spreading device for the leaf material in the longitudinal direction, by a subsequent first sorting station with a conveyor belt designed to hold individual leaves and a separating unit for foreign bodies, and by a second sorting station along said conveyor belt with a testing member for the quality of the individual leaves and a signalling member controlled by the testing member which actuates classification device for the leaves, said conveyor belt per channel being made of a material impermeable to air and provided with perforations grouped into clusters arranged in spaced relationship along the conveyor belt, the space being somewhat larger than the leaves to be held, the said conveyor belt passing over drums with shells permeable to air and over guide rolls and has its group of holes in the area where individual leaves are caught and held pass over perforated wall portions of flat or sector-type hollow bodies of which those located in the area between the entrance and the classification device are permanently connected to an underpressure system while the hollow bodies associated with the classification device are connected to the underpressure system via electrically operable valves, and including a second conveyor belt which is provided with groups of holes like the first conveyor belt and passes over drums with shells permeable to air and, in so doing, passes for a length of its path in parallel with and close to the first conveyor belt which is moved in the downward direction, in the range of the classification device has its groups of holes passing over perforated wall portions of flat or sector-type hollow bodies which are connected, via electrically operable valves, to an underpressure system, and by sorting channels arranged underneath the classification device, the said channels extending transversely over all classification devices of the individual parallel channels, and by control circuits arranged between the valves and the signalling device.

11. A sorting device according to claim **10** characterized by the fact that the signalling device and the control circuits to the valves are so designed that the appearance of the signal corresponding to the quality class of the first sorting channel causes the underpressure valves to open for the flat hollow body located behind the downward running section of the first conveyor belt and the sector-type hollow body located downstream of the first body as well as for the flat hollow body located behind the return section of the first conveyor belt, that the appearance of a signal corresponding to the quality class of the second sorting channel causes the underpressure valves to open as in the presence of the signal corresponding to the quality class of the first sorting channel with the exception of that for the hollow body located behind the returning lower section of the conveyor belt, that the appearance of a signal corresponding to the quality class of the third sorting channel causes the underpressure valves to open for the hollow bodies located behind the second conveyor belt in the range of the section parallel with the first conveyor belt as well as for the flat hollow body which is arranged behind the section of the second conveyor belt moving away from the parallel range, and that the appearance of a signal corresponding to the quality class of the fourth sorting channel causes the underpressure valves to open as in the presence of the signal corresponding to the quality class of the third sorting channel and additionally the underpressure valve of a further sector-type hollow body arranged directly downstream of the flat hollow body which has for a result that the leaves located on the various groups of holes in the first conveyor belt are held fast by suction as long as the group of holes involved passes through the range of those hollow bodies of which the underpressure valves are open thus dropping

into the first and, respectively, second sorting channel located underneath, or are taken over by the suction of a group of holes in the second conveyor belt and held fast while the group of holes involved passes through the range of the perforated walls of those hollow bodies of which the underpressure valves are open so that they drop into the third and, respectively fourth sorting channel located underneath.

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