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(54) Feeding tobacco.

(57) In accordance with the present process and device the tobacco contained in a reservoir is selectively and pneumatically carried to a separator (20) by means of a flow of air inside a feeding tube (10). Within the air separator (20) the air is removed from the stream of particles of tobacco which continues in a direct even path until it reaches the upper open end of a first column (30) of a first tobacco metering and opening set (40, 50, 60).

The metered and opened tobacco stream is then pneumatically carried and injected into an upward flow of air in a vertical duct (100) for separation of the stems and heavy fragments. The upward flow of air containing tobacco leaf particles is accelerated and turned downwards then being decelerated within a closed chamber (150) from where the air is partially extracted while the tobacco leaf particles follow their straight downward course, reaching the lower exit mouthpiece (151) of the mentioned closed chamber (150) and from there to the upper open end of a second column (70) of a second tobacco metering and opening set (40a, 50a, 60) with its exit communicating with the entrance to the machine which is usually one for manufacturing cigarettes.

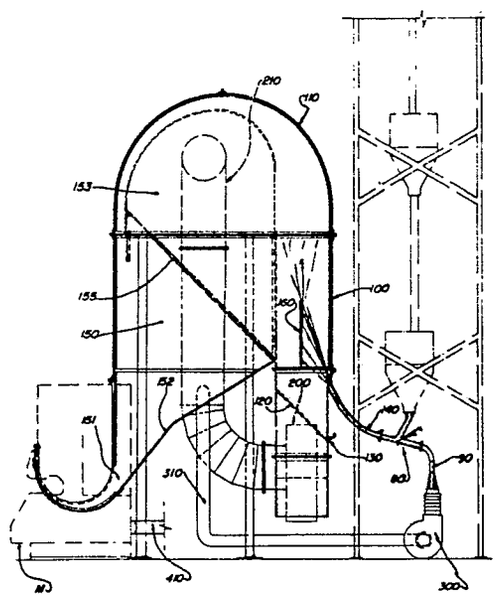

FIG. 8

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Process and Device for Metering and opening tobacco particles and/or separating stems from a tobacco stream fed to a cigarette machine or to a machine for packaging tobacco for sale.

The present invention applies to a process and device for metering and opening or separation of a mass of particles of tobacco and/or pneumatic separation of stems from tobacco particles contained in a stream of particles of tobacco to be fed in an automatic and continuous flow to a machine manufacturing cigarettes or other machines for final preparation of tobacco for sale as, for example, roll your own packaging machines.

In conventional cigarette manufacturing a shower of tobacco particles is fed on to a surface to form the tobacco rod which moves transversely across the flow of tobacco, this then is enclosed in a strip of paper to make the cigarette rod to be cut into the length of the cigarettes to be produced.

The flow of tobacco particles can be fed directly on to the surface which forms the rod or first carried to a series of vacuum wheels to form subflows of tobacco from which the final rod is obtained.

The flow is produced by metered feeding from a reservoir of cut tobacco particles, usually attached to a cigarette manufacturing machine or a machine for packaging tobacco for sale.

The metered feeding of tobacco particles is traditionally accomplished by using a carding cylinder which revolves within a mass of tobacco to lift out tobacco particles on its surface, the excess being removed from the carding cylinder by a second carding cylinder revolving in an opposite direction. The tobacco mass is provided by the tobacco being fed from the reservoir by an elevating device.

The use of carding cylinders and of the elevator results in degrading the tobacco particles thus reducing the tobacco's filling power, in other words its ability to fill the internal volume of the cigarette to the desired firmness is reduced.

Another system used formerly involves supplying tobacco from a reservoir provided with metering and picking rolls located at the bottom end thereof to meter the tobacco leaving it at a desired rate and to provide a flow of particles of tobacco opened or separated from one another.

Although it decreases the degree of tobacco degradation the above mentioned system has the inconvenience of requiring a tobacco air separator in which tobacco particles are thrown against the surface of the separator, becoming degraded before they pass, with a certain amount of further degradation, through an air lock provided with blades which function as a seal to eliminate the entry of air into the system for conveying the particles of tobacco from the reservoir to the machine. This deficiency exists in all the former systems which call for an air flow to convey the particles and a separator with the tobacco exit blocked by an air lock.

In summary, it may be said that the former systems of metering and opening tobacco particles provoke to a lesser or greater degree an undesirable degradation of the tobacco as a result of using carding cylinders, mechanical elevators, air separators with rotating air-locks and/or metering rolls under columns of tobacco and picking rolls prepared to remove the tobacco held on the teeth of the carding drums.

The first objective of this present invention is to provide a process and a device for metering and opening tobacco particles to be fed automatically and continually to cigarette manufacturing machines and other equipment, with the object of producing a continuous homogeneous stream of opened tobacco particles submitted to a reduced rate of degradation compared to the solutions offered by previous techniques; carrying the tobacco on a continuous air flow at low speed between the reservoir and the means for the separation of air and tobacco is, thus considerably reducing degradation by attrition with the walls of the tobacco conveying tubes; and a device of the aforementioned type containing a minimum of complex maintenance and expensive parts resulting in an extremely simple and robust installation.

As regards the problem of separation of the stems, several systems are known for separating them from the agglomerated tobacco in the stream of tobacco particles fed to a cigarette manufacturing machine, and these systems used formerly were developed to effect mechanical separation of stem from a stream of homogenised tobacco. Although this does effect the separation of the stems from the stream of cut tobacco particles, this mechanical separation produced an undesirable degrading of the tobacco particles, considerably diminishing its filling power when producing the cigarette rod.

Thus the second objective of the present invention is to provide a process and a device for pneumatic separation of the stems from a stream of particles of tobacco fed to a cigarette manufacturing machine, permitting the separation of the stems and possible portions of agglomerated tobacco within a stream, and opening of the tobacco particles, with the separation of the stems being carried out with a minimum of degradation of the tobacco particles.

As may have been observed in certain applica-

tions such as machines for packaging tobacco for sale, it is merely necessary to submit the stream of tobacco particles fed into the machine to operations for opening or separating the tobacco particles and metering the supply of them to the machine being fed.

In cases of cigarette manufacturing machines it is necessary for the stream of tobacco particles, in addition to being submitted to metering and opening, to go through a process of separation of the stems from the tobacco particles to be fed to the machine.

When effecting sequential metering operations of tobacco particles, their opening and separation of the stem fragments from the stream of particles going to the cigarette manufacturing machine, the particles which leave the stem separating device go directly to the entrance of the cigarette manufacturing machine without going through any additional opening or metering operation. In this manner if small agglomerations of tobacco particles appear inside the separator these light clumps are carried to the rod forming part of the machine and can in some cases cause operational problems or even stop it.

A third objective of this present invention is to provide a process comprising a device to meter and open tobacco particles and to separate fragments of stems from the particles of tobacco fed to a cigarette manufacturing machine which allows for a continuous homogeneous metered flow of opened tobacco particles to go to the machine, the particles having a considerably reduced degree of degradation, with a reduced risk of feeding agglomerated particles of material to the machine.

The process for metering and opening tobacco particles to feed machines for final preparation of tobacco for sale, such as manufacturing cigarettes or packaging tobacco, includes a basic operation of transporting a load of particles in a metered and continuous stream from a reservoir to the machine. According to this present invention the first objective is attained by this process composed of the following steps: selectively and pneumatically connecting a load of tobacco particles from the reservoir by means of an air flow through a feeding tube in order to take the tobacco through it to a point outside the reservoir; separating the conveying air flow from the tobacco at the point outside the reservoir and directing the tobacco stream to a first metering column, maintaining the level of tobacco between predetermined minimum and maximum levels (by selective control of the pneumatic connection of the tobacco in the reservoir to the conveying air flow); progressively removing the tobacco particles through the lower end of the first metering column at a variable speed and simultaneously submitting the particles to mechanical opening; directing the particles removed from the first metering column to the upper end of the second metering device below the first one, maintaining the level in this second column between predetermined minimum and maximum levels (by means of controlling the speed of removal of the tobacco from the first column); progressively removing the tobacco particles through the lower metering column at a rate corresponding to that required by the machine being fed and, at the same time, the particles undergoing a second mechanical opening process; and carrying the opened tobacco particles from the lower end of the second metering column to the machine being fed with the tobacco.

The device for metering and opening the particles to go to a machine, for final preparation of tobacco for sale, coming from a reservoir containing a load of tobacco particles, and related to the first objective of the invention comprises: a tobacco feeding tube with its selective pneumatic opening end connected to the tobacco load and its exit end located at a point distant from the reservoir, this tube directs conveying air into a separator in the form of a hollow box which has an entrance connected to the exit end of the feeding tube, an air exit displaced in relation to the direction of the conveying air flow, and a conveyed product exit axially lined up with the entrance of the conveying air; a first metering column with its upper end connected to the exit of the tobacco from the air separator and its lower end open; a first rotating metering roll provided with radial pins, placed under the lower end of the first metering column so as to effect controlled movement of the tobacco downwards through the lower end of the first metering column only when rotating; a first rotating separating roll provided with radial pins and placed adjacent to the first metering roll in order to pull downwards the tobacco particles located in the lower end of the first metering column; a second metering column placed below the first with its upper end provided with a hopper receiving the tobacco from the first metering column and its lower end open; a second rotating metering roll provided with radial pins, placed under the bottom end of the second metering column so as to effect the controlled movement of the tobacco downwards through the lower end of the second metering column only when rotating; a second rotating separating roll provided with radial pins, located alongside the second metering roll in order to move downwards the particles located in the lower end of the second metering roll and to direct them to the machine to be fed.

The process and the device whose basic characteristics are defined above allow for obtaining a continuous uniform stream of cut tobacco with a

reduced degree of degradation since the air separation is made practically without altering the route of the tobacco particles within the air separator and then conveying them directly from the feeding tube to the upper metering column which then functions as an air-lock without any degrading effect on the tobacco which occurs in the conventional methods using a rotating drum with blades as an air-lock. Furthermore the two sets of metering and separating rolls allow for smooth controlled removal of the tobacco from the respective metering columns while effecting the opening of the tobacco particles in two stages and producing a final continuous uniform tobacco stream with a speed that varies according to the quantity of tobacco required by the machine.

The second objective of the invention relates to the problem of separating/metering devices as described above comprises stages of introducing a tobacco stream into an air venturi passing through a feeding duct; introducing a flow of air and tobacco into an ascending separating air current; collecting the stems which fall by gravity against the upward separating air current; accelerating this rising air current while changing it to a downward direction; separating the particles of tobacco from the air current and directing the particles to the entrance of the machine.

The device for separating stem fragments and agglomerated tobacco contained in a stream of particles of tobacco, with its particle mass already opened and metered, is composed of a vertical separation duct containing an upward air current, a lateral entrance for the conducting air and tobacco particle stream and a curved upper descending transversal section with its end turned downward, connected to the upper part of a closed air separator housing, having a lower exit for the tobacco and low pressure section provided with an air exit.

The progress and the device mentioned above, by means of simple methods and operations, permit highly efficient separation of the tobacco particles from one another and of the stems and possible portions of agglomerated tobacco which may still remain in the stream of homogenised tobacco coming from the reservoir or the separating/metering device mentioned above, with the separation being carried out by smoothly and automatically transporting the tobacco particles and removing the stems and heavier portions by gravity against an upward air flow controlled to carry only the tobacco particles themselves, which considerably minimises degradation of the tobacco.

The third objective of the invention is attained by the process and device to meter and open the particles of tobacco and simultaneously separate the stem fragments and agglomerated tobacco from particles to be supplied to a machine, based on the air separation, metering and opening process related to the first objective of the invention and, further, an operation for pneumatically separating stem fragments in the process relating to the second objective of the invention. This united operating process involves stages of: separating the tobacco conveying air flow at a point distant from the tobacco reservoir; directing a stream of tobacco to a first metering and opening set and submitting the tobacco stream to at least a first joint operation mentioned for metering and opening the tobacco particles; pulling the metered and opened stream of tobacco particles through a continuous air flow passing through a feeding tube and carrying it to a pneumatic stem fragment separation device; submitting the metered and opened tobacco stream to the mentioned operation of pneumatic separation of stem fragments; directing the particle stream separated from the stem fragments to at least a second tobacco particle metering and opening set; and conducting the stream of tobacco particles duly metered and separated from one another to the cigarette manufacturing machine.

As for the device itself, the third objective of the invention is attained by providing a device for carrying out simultaneous metering and opening of the particles tobacco and separating the stem fragments and agglomerated tobacco from a stream of tobacco to be supplied to a cigarette manufacturing machine. For example, such device uses sets for air separation, metering and particle opening necessary to fulfill the first objective of the invention plus an apparatus for pneumatic separation of stems related to the second objective. This new device operating jointly comprises: a device for separating the air conveying flow of a pneumatically conveyed tobacco stream coming from a tobacco reservoir; at least the first of the mentioned joint tobacco particle metering and opening devices receiving a stream of tobacco from the tobacco/air separation device; a feeding tube conducting a flow of air communicating with the exit of tobacco particles from the mentioned first metering and opening device; one of the mentioned devices for pneumatic separation of stem fragments receiving a stream of metered and opened tobacco particles from the conducting tube and separating the particles from the stems, this device having an exit for the tobacco; at least a second of the mentioned joint tobacco particle metering and opening devices with the entrance thereof connected to the exit of the device for pneumatic separation of the stem fragments and with the exit of the second joint tobacco particle metering and opening device connected to the cigarette manufacturing machine.

The process and the device referred to above permit obtaining a continuous uniform stream of tobacco particles separated from one another and

free from undesirable stem fragments, metered in accordance with the operating needs of the cigarette manufacturing machine.

The use of at least one first tobacco particle metering and opening set placed within a stem separator facilitates pneumatic removal of fragments and permits at least one second metering and opening set to function only on an already previously metered and opened tobacco particle stream substantially free from stem fragments, producing final opening and metering of a degree of efficiency impossible to secure by processes know up to the present time.

The invention shall be described as follows with reference to the attached diagrammatic drawings in which:
Figure 1 shows a side view somewhat simplified, of the tobacco particle metering and opening device which is the object of this invention, Figure 2 shows a front view of the device shown in Figure 1, Figure 3 shows an enlarged partial view of the air separator mounted on the upper part of the sections shown in Figure 1 and 2, Figure 4 illustrates a side view of the false air entrance valve on the feeding tube, Figure 5 shows an enlarged partial view of the typical set of metering and separating rolls, the lower portion of the tobacco and the collecting box or hopper, Figures 6 and 6a respectively show a side view and an end view of the metering rolls, Figures 7 and 7a respectively show a side and an end view of the separating or opening rolls, Figure 8 shows a side view of the stem and agglomerated tobacco separating device, Figure 9 shows a side view of the stem separating device of the previous figure but turned 90° in relation to the Figure 8 view, Figure 10 shows a plan view of the device, Figure 11 shows an enlarged longitudinal section of the pneumatic venturi for air conveying the particles of tobacco into the air conducting stem separator device, Figure 12 shows a somewhat simplified side view of the device to effect jointly the metering and opening of the tobacco particles along with separation of the stem fragments from the particle stream to be supplied to the cigarette manufacturing machine, Figure 13 is a front view of the same device but turned 90° in relation to the view in the previous figure, and Figure 14 shows a plan view of the device illustrated in Figures 12 and 13.

According to Figure 1 to 7a the device for metering and opening tobacco particles comprises a feeding tube 10 (Figure 3) with its lower end (not illustrated) placed within a reservoir of particles tobacco (also not illustrated) and its upper end connected to an air separator 20, known means being provided (not illustrated as they do not belong to the present invention) to effect air flow though the mentioned tube in order to pneumatically carry the particles of tobacco from the reservoir to the air separator 20 in a mixed tobacco and air flow.

In accordance with the illustrated solution the tobacco stream can be interrupted by means of selective automatic opening of a valve 11 (Figure 4) provided on feeding tube 10, above the tobacco reservoir. When the valve 11 is opened the flow of air produced through the feeding tube 10 goes into the latter through valve 11 whereby the particles of tobacco stop being sucked from the reservoir.

Valve 11 comprises a cylindrical cap 12 placed against a side opening in the feeding tube 10 and articulated to it by means of a lever 13 moved by a piston 14 controlled by an electro-magnetic valve.

Air separator 20 comprises a hollow box with a side entrance mouthpiece 21 sloped upwards to which is attached the upper end of feeding tube 10. The bottom of the separator box contains a lower tobacco exit duct 22 with its basic portion lined up on an axis with the entrance mouthpiece 21 and having its end in the form of a wide angle curve with its end turned vertically downward and its mentioned lower exit forming an elongated transversal rectangular section. The upper wall of the separator box located above the side entrance mouthpiece 21 consists of a screen 24 on which there is a collecting hood 25 containing an air exit duct 23.

The lower tobacco exit duct 22 of the air separator 20 is fitted to the open upper end of an upper metering column 30, of a rectangular transversal section substantially the same as that of the mentioned exit duct 22.

The lower open end of the upper metering column 30 is bevelled towards its smaller dimension and placed in an eccentric but secant form about a first metering roll 40 which contains a number of rods or pins 41 radially spaced along the full cylindrical surface of roll 40, this set being constructed so that the particles of tobacco coming from separator 20 accumulate in the upper metering column 30 resulting in a seal against the passage of air passing through the separator 20. The level of tobacco in the metering column is maintained by means of a photoelectric sensor 31 which operates valve 11 when the tobacco reaches a certain height in this upper column 30 opening the valve and interrupting the conveying of the tobacco from the reservoir while maintaining the flow of air through feeding tube 10.

As better illustrated in Figure 5 the first metering roll 40 is located within a first hopper 50 along with a first separating roll 60, of a smaller diameter and provided with a number of radial pins 61 closer together than the pins 41 of the first metering roll 40 and placed in a fashion to penetrate between or interdigitate with the latter when separating roll 60

is rotating in an opposite direction and at greater speed than that of metering roll 40. The first metering and separating rolls (40,60 respectively) are activated at synchronised and variable speeds by appropriate motors (not illustrated) including speed regulators and controllers.

The first metering roll 40 sends the tobacco downward from the bottom of the upper metering column 30 while the first separating roll 60 removes the tobacco displaced by the first metering roll 40, opening it and allowing it to fall into the first hopper 50 which is provided with a lower mouthpiece connected to the upper open end of a lower metering column 70 having a rectangular transversal section of the same width and less thickness than those of the upper metering column 30 and the same dimensional variation of the latter on its whole longitudinal length.

This lower metering column 70 as shown in the Figure 1 has in its upper section three photoelectric sensors 71 which control the speed of the first metering and separating rolls (40,60) from rapid, slow to stop, depending on the level the tobacco reaches inside lower metering column 70.

The lower end of lower metering column 70 is bevelled in the same manner as the upper column 30 and placed also in an identical arrangement over a set of second metering and separating rolls (40a,60a) placed within a second hopper 50a, the lower mouthpiece of which is connected to the feeding means of the machine (not illustrated) to receive the metered tobacco.

The second metering and separating rolls (40a,60a) are activated revolving at variable speeds by motors (not illustrated) commanded from the machine itself in order to remove and separate the amount of tobacco required by the machine from second metering column 70.

The second metering and separating rolls (40a,60a) also rotate in opposite directions to effect a second separation of the metered tobacco from lower column 70 so as to secure a final stream of homogeneous tobacco with a minimum of degradation.

Air separator 20, metering columns 30, 70, hoppers 50, 50a and metering and separating rolls (40,40a,60,60a) are mounted on the supporting structure shown in a simplified manner in Figure 1 and 2.

The lower mouthpiece of the second hopper 50a can be connected directly to the feeding mouthpiece of a machine for final preparation of tobacco for sale, such as a pipe tobacco packaging machine, or can be attached to a stem fragment or agglomerated tobacco particle device as illustrated in Figure 8 to 11 as described below:

As per Figure 8 to 11 the stem separating device comprises first of all a vertical duct 100 for gravity separation of stems and other heavy portions, with its lower end closed and its upper portion prolonged in a curve 100 of wide angle with its transversal section decreasing progressively in its first quarter. The lower portion of opening 100 is connected to a pressurised air separation source 200 by means of an air duct 220, and above the entrance of this air duct 220 the separation duct 100 has a wall 120 sloped downward towards the outer side of the separation duct and composed of a screen to allow the descending air coming from the source of separation air 200 to go through upwards but to prevent the downward passage of the stems or portions of agglomerated tobacco which fall into the separation tube. The side wall of the separation duct 100 is provided with an opening 130 right above the lower edge of the screen 120 to allow the stems and portions of agglomerated tobacco which fall on the mentioned inclined screen 120 to pass out of the separation duct 100. The outer side wall of the separation duct 100 is further provided with a rectangular elongated duct 140 sloped downward and projecting in an arc away from the separation duct 100 above the level of the sloped screen mounting 120, in order to serve as an entrance for the homogenised tobacco stream into the separation device.

A venturi 80 is mounted on entrance duct 140 connected to the source of homogenised tobacco which in the illustrated example serves as a lower exit duct of the metering and particle opening device illustrated in Figure 1 to 7a. The other end of the venturi 80 is mounted on a conducting air feeding tube 90 coming from some source such as the cigarette manufacturing machine M itself but which, as in the illustrated example, is a fan 300.

The end of the duct of the upper curve 110 of separation duct 100 communicates with the upper section of a closed air separation chamber 150 having a lower duct 151 for the tobacco go to the machine M and which is vertically lined up with the exit of the curve 110, a back wall 152 sloped downwards in the direction of the tobacco exit mouthpiece 151 and an upper low pressure section 153 located inside the space defined by the duct curve 110 separated from the other section of air separation chamber 150 by a screen 155 to retain the tobacco particles and further provided with an air exit to which there is attached an air exhaust duct 210 leading to the suction side of the air separation source 200 which can be in the form of a fan, and with the exhaust air duct 210 connected to the suction side of fan 300 by means of tube 310.

In the drawing the air coming from the machine M is conducted through a tube 410 to a filter 400 and to another dust retention device.

The venturi 80 shown in Figure 11 is in the

form of a straight tubular extension 81 of a rectangular elongated horizontal transversal section incorporating an upper sloped tube 82 also of a rectangular transversal section and provided further with a blocking plate 83 inserted transversely and slanted in the tubular extension 81 and tube 82, and which can be set in different positions by tightening a screw 84 placed on support 85 thus permitting a certain amount of regulation of the air conveying current which reaches the venturi.

With the construction defined heretofore the apparatus in question permits the particles of tobacco to be exhausted by the venturi 80 into the conveying air flow contained in the feeding tube 90 and then be conducted into the separation duct 100 where the rising air current carries the particles of tobacco upwards separating them still further and progressively accelerating them through curve 110 while the stems and aggregated portions fall onto the inclined screen 120 and slide out of the separation duct 100.

The tobacco particles which reach the air separation chamber 150 are sent vertically downwards towards the exit mouthpiece 151 and to the machine M with a certain amount of air while the remaining air is deviated upwards through screen 155 into the low pressure section 153 from whence it is blown into the lower section of the vertical separation duct 100.

The stem separating device can also include a second dust filter 250 (Figure 10) connected to the air separation duct 200 through an interconnecting duct 240, in order to avoid any connection between the discharge of air from the machine M and the discharge of air from the stem separation device and pressure disequilibrium between the two pneumatic circuits which would be harmful to the machine's operation.

In Figures 8 and 12 the stem separating device is further provided with a deflecting plate 160 placed vertically which separates the inside of the separation duct 100 in half transversally to the flow of tobacco entering the duct through side mouthpiece 140.

The deflecting plate is of a size to block the path of the stem fragments and tobacco particles which penetrate transversely and inclined upwardly into separation duct 100 deviating the particles of material upwards so as to effect its improved distribution in the upward separation air current.

The deflecting plate 160 should be thin in order not to interfere with the upward air separation current and extends sideways over the whole width of the feeding mouthpiece 140 which, as illustrated, occupies the whole width of the quadrangular section of separation duct 100.

The use of the deflecting plate 160 prevents the stem fragments and part of the tobacco particles cast into the separation duct 100 from striking the wall of this duct near the feeding location 140 where they tend to agglomerate resulting in part of them falling in lumps against the upward air separation current. Lumps of stem fragments and tobacco particles can be formed in the upward current, i.e., by concentration of these fragments and part of the particles in the back part of separation duct 100 near the side mouthpiece 140.

It so happens that some of these lumps can be of sufficient weight to provoke their fall and removal out of the duct, taking along particles of tobacco which should be carried to the cigarette manufacturing machine, while others of the lumps containing stem fragments may be unduly carried upward and taken to the machine. In the former case loss of tobacco occurs and in the latter the stem fragments are carried to the cigarette manufacturing machine.

Figures 12, 13 and 14 illustrate the device for performing a joint operation of metering and opening the tobacco particles and also separate the stem fragments and agglomerated particles from a stream of particles of tobacco to be supplied to a cigarette manufacturing machine.

According to the three mentioned figures the device for metering and opening the tobacco particles and separating the stem fragments comprises a feeding tube 10 with its lower end (not illustrated) placed inside a tobacco particle reservoir (also not illustrated) and with its upper end connected to an air separator 20, there being supplied by known methods (not illustrated) means to create a continuous air flow through the feeding tube 10 so as to carry the particles of tobacco from the reservoir to the air separator 20 in a mixed tobacco and air current. The control of the tobacco stream in the feeding tube 10 and construction of the air separator are described in referring to Figure 3 and 4 relating to the device for metering and opening the tobacco particles.

The upper open end of a first upper metering column 30 is attached to a lower tobacco exit mouthpiece 22 of the air separator 20, provided with a photoelectric sensor 31 and with its lower end placed over a first metering roll 40 inside a first hopper 50 along with a first separating roll 60. The arrangement formed by the first metering column 30, by the first hopper 50 along with the first metering roll 40, and by the first separation roll 60, forms the first tobacco particle metering and opening group built and operating in the same manner as defined in relation to the corresponding parts of the device for tobacco particle metering and opening illustrated in Figures 1, 2, 5, 6, 6a, 7 and 7a.

The first hopper 50 is provided with a lower mouthpiece connected to the middle mouthpiece 82 of a venturi 80 built as indicated in Figure 11,

the entrance mouthpiece of which is attached to an air conducting feeding tube 90 coming from a pressurised air source such as a fan 300.

The device for separating the stems is built and operates practically the same as described in relation to the same device illustrated in Figure 8, 9 and 10. Figure 12, 13 and 14 show the lower portion of the separation duct 100 attached over the exit from the centrifugal fan 200, and above the air exit from the fan 200 the separation duct 100 is provided with an inside wall 120 in the form of a screen to allow for passage of the air ascending from the air separation source and to retain the stem fragments or other particles of tobacco that are undesirable for the machine which fall inside the separation duct 100, being directed outside of it by the side opening 130. The entrance of tobacco to the separation duct 100 is effected by means of mouthpiece 140 attached to the exit end of the venturi 80.

The end mouthpiece of the upper curve 110 of the separation duct 100 communicates with the upper part of a closed air separation chamber 150 having a lower mouthpiece 151 for tobacco removal vertically aligned with the exit mouthpiece of curve 110, a back wall 152 sloping downward in the direction of the tobacco exit mouthpiece 151 and an upper low pressure section inside the space formed by the duct curve 110, separated from the rest of the air separation chamber by a screen 155 which retains the tobacco particles and further provided with an air exit to which exhaust duct 210 is attached connected to the suction side of the air separation fan 200, the air exhaust duct 210 further connected to the suction side of fan 200 by a tube 310.

The tobacco particles which leave the stem separation device are sent to the upper end of a second metering column 70 provided with photoelectric sensors 71, with its lower end attached to a second hopper 50a containing a second metering roll 40a and a second picking roll 60a forming a second tobacco particle metering and opening set built and operating in the same manner as described in relation to the first metering and opening set 40, 50, 60.

The separation duct 100 is further provided with a deflecting plate 160 already described in relation to Figure 8.

In the illustrated example the conveying air fan 300 suction duct 310 is connected to air exhaust duct 210. It should however be noted that the interconnection of suction duct 310 to air exhaust duct 210 is a possible alternative solution.

With the air conveying fan 300 the exhaust air which comes from the machine M is carried through a tube 410 to a filter 400 or similar dust retaining device. Thus there is no need to provide air feeding ducts between the machine M and the venturi 80 and, therefore, no limitation of availability of air conduction flow in high production capacity systems.

All illustrated in Figure 14 this present invention also foresees inclusion of a second dust filter 250 connected to the air separation duct 100 through an interconnecting duct 240, eliminating any interconnection between the air discharged from the machine and the air discharged from the separation device and preventing the formation of pressure disequilibrium between the two pneumatic circuits which would harm the operation of the machine.

Claims

1. A process for metering and opening tobacco particles in a stream of tobacco fed to a machine for packaging tobacco for sale, including a basic stage of transporting in a metered and continuous manner a load of tobacco particles from a reservoir to the machine referred to, CHARACTERISED by containing the following steps: selectively and pneumatically conveying the load of tobacco particles from the reservoir with flow of air through a feeding tube in order to produce a stream of tobacco within this tube from the reservoir to a point distant from the latter; separating the conveying air from the tobacco stream at the point distant from the reservoir and sending the tobacco to a first metering column where the tobacco is maintained at a predetermined level; progressively and at variable speeds, removing the tobacco through the lower end of the first metering column while submitting the tobacco particles to a first mechanical opening; directing the separated tobacco particles to the upper end of a second metering column, placed below the first metering column, where the quantity of tobacco is kept at a predetermined level; progressively removing tobacco through the lower part of the second metering column at a rate corresponding to that required by the machine while submitting the tobacco particles to a second mechanical opening; and conducting the particles from the lower part of the second metering column to the machine to be fed with the tobacco.

2. A process according to Claim 1, CHARACTERISED by the fact that the separation of the conveying air from the tobacco stream is effected without altering the direction of the flow of the latter and using a column of tobacco in the first metering column as a seal against the entrance of air into the first metering and tobacco opening set.

3. A process according to Claim 1 or 2, CHARACTERISED by the fact that in the mentioned separation of the conveying air and product, the product is directed directly towards the product

exit and the conveying air is removed from the top of the separator at a point not aligned with the entrance of the conveying air tube.

4. A process according to any one of Claims 1-3, CHARACTERISED by the fact that the pneumatic connection of the conveying air flow to the tobacco contained in the reservoir is obtained by closing a false air entrance to the feeding tube at a point distant from the tobacco feed system.

5. A process according to Claim 4, CHARACTERISED by the fact that the level of tobacco inside the first metering column commands the opening and closing of the mentioned false air entrance into the feeding tube.

6. A process according to any one of the preceding claims, CHARACTERISED by the fact that the flow of tobacco in the feeding tube goes upwards at least in the section adjacent to the tobacco reservoir.

7. A process according to any of one of the preceding claims, CHARACTERISED by the fact that each operation for opening the tobacco particles involves a first downward movement of the particles in the bottom end of each metering column, a second dislocation going downwards and, finally, falling of the particles by gravity in the direction of the lower metering column, and thence to the machine.

8. A device for metering and opening tobacco particles in a stream of tobacco fed to a machine for packaging tobacco for sale, said apparatus comprises: a tobacco reservoir, a tobacco feeding tube (10) with its selective pneumatic entrance end connected to a load of tobacco and its exit end distant from the reservoir, this tube (10) directing a flow of air carrying tobacco in the direction of the exit end; an air separator (20) in the exit end of the feeding tube (10), an air exit (23) dislocated in relation to the entrance direction of the air conduction flow and a tobacco exit (22) lined up axially with the entrance (21) of the air flow; a first metering column (30) with its upper end connected to the tobacco exit (22) of the air separator (20) and with its lower end open; a first rotating metering roll (40) provided with radial pins (41) placed under the lower end of the first metering column (30) in order to produce, only when rotating, dislocation of the tobacco in a downward controlled flow from the first metering column (30); a first rotating separating roll (60) provided with radial pins (61) placed alongside the first metering roll (40) in order to pull downwards the tobacco particles dislocated through the lower end of the first metering column (30); a second metering column (70) placed below the first one with its upper end provided with a hopper (50) to receive the tobacco from the first metering column (30) the lower end of said second metering column being open; a second rotating metering roll (40) provided with radial pins and placed under the lower end of the second metering column (70) in order to effect, only when rotating, controlled dislocation of the tobacco through the lower end of the second lower metering column; and a second rotating separating roll (60a) provided with radial pins (61a) and placed adjacent to the second metering roll (40a) so as to pull downwards the tobacco particles dislocated at the lower end of the second metering column (70) and direct them to the machine.

9. A device according to Claim 8, CHARACTERISED by the fact that the pneumatic connection between the feeding pipe (10) and the load of tobacco is effected by closing a valve (11) mounted on an air entrance opening provided on the feeding tube (10) at a point distant from the tobacco particle mass.

10. A device according to Claim 9, CHARACTERISED by the fact that the opening and closing of valve (11) is commanded automatically by means of tobacco level sensors (31) provided on the first metering column (30).

11. A device according to Claim 8, CHARACTERISED by the fact that the air entrance (21) in the air separator (20) is placed eccentrically in the upper part of the separator with its geometric axis sloping and the tobacco exit (22) is placed in the lower part of the separator and the air exit (23) is located in the upper part of the separator.

12. A device according to Claim 11, CHARACTERISED by the fact that the upper part of the separator (20) contains a screen (24) over which a hood (25) is mounted incorporated with the air exit (23).

13. A device according to any one of Claims 8 to 12, CHARACTERISED by the fact that separating rolls (60, 60a) rotate in an opposite direction from that of the respective metering rolls (40, 40a)

14. A device according to Claim 14, CHARACTERISED by the fact that the rotation of the first metering (40) and separating (60) rolls is automatically controlled for different speeds by means of tobacco level sensors (71) provided on the lower metering column (70).

15. A device according to Claim 14, CHARACTERISED by the fact that the revolving speed of the second metering and separating rolls (40a,60a) is controlled directly by the machine to be fed with tobacco.

16. A device according to Claim 8, CHARACTERISED by the fact that the metering (40 40a) and separating (60 60a) rolls are placed inside respective hoppers (50, 50a).

17. A device according to Claim 8, CHARACTERISED by the fact that the lower ends of the metering columns (30, 70) are shaped in order to accompany the approximate shape of the upper quarter of the respective metering rolls (40, 40a).

18. A device according to Claim 8, CHARACTERISED by the fact that the metering columns (30, 70) are of elongated rectangular transversal section.

19. A process for separating stems from a stream of tobacco feeding a machine for packaging tobacco for sale as well as for a cigarette manufacturing machine, in order to separate the stem fragments and the agglomerated portions of tobacco particles from a flow of tobacco submitted to metering and opening operations, such as in the process defined in any of Claims 1 to 7, to be fed to the mentioned machine, CHARACTERISED by the fact that it comprises the following steps: introducing a stream of metered and opened tobacco into a continuous air current passing through a feeding tube communicating with a source of pressurised conveying air; introducing a flow of air and tobacco into a continuous upward current of air in a vertical separation duct with its lower end communicating with a source of pressurised separation air, controlling this upward current so that it carries only the opened tobacco particles, leaving the stems and agglomerated portions to fall in the direction of the lower end of the duct and out of the separation duct; progressively accelerating the speed of the upward air separation flow while changing it to a downward direction; separating the accelerated downward flow from the particles of tobacco leaving the upper part of the separation duct leading to the inside of the closed air separation chamber, decreasing the speed of the air flow and directing it to a low pressure section in the mentioned chamber; continually removing part of the air from the mentioned chamber; continually removing part of the air from the mentioned low pressure region of the chamber; and conducting the particles of tobacco directly to the exit mouthpiece of the device.

20. A process according to Claim 19, CHARACTERISED by the fact that the introduction of the tobacco stream into the conveying air flow is effected in the venturi by the air fed to the venturi after exhaustion in the tobacco conveying stage.

21. A process according to Claim 19 or 20, CHARACTERISED by the fact that the conveying air flow is introduced into the separator air flow upwardly, forming an angle with the latter.

22. A process according to Claim 19,20 or 21 CHARACTERISED by the fact that the conveying air and tobacco flow is in a rectangular form of reduced width and of a length corresponding to the rectangular transversal section of the vertical portion of the separation duct.

23. A process according to any one of Claims 19 to 22, CHARACTERISED by the fact that the source of separation air is provided by a fan with its discharge connected to the lower end portion of the separation duct.

24. A process according to any one of Claims 19 to 23, CHARACTERISED by the fact that removal of the air from the low pressure section of the air separation chamber is effected by interconnecting the region to the suction side of a fan.

26. A process for separating stems from a tobacco stream feeding a machine for packaging tobacco for sale according to any are of Claims 19-24, CHARACTERISED by the fact that the geometric axis of the downward end portions of the separation duct is secant to the tobacco exit mouthpiece of the mentioned separation chamber.

27. A device for separating stems from a tobacco stream feeding a machine for packaging tobacco for sale also as for a cigarette manufacturing machine, in order to separate the stem fragments and the agglomerated tobacco particle portions from the tobacco in a stream submitted to metering and opening operations, such as those effected by the device defined in any of claims 8 to 19 and to be fed to the mentioned machine, CHARACTERISED by the fact that it involves: a feeding tube (90) containing a flow of air produced by a source of pressurised conveying air (300) connected to the end of a tube (90) the middle portion (80) of which is pneumatically attached to a stream of tobacco in order to receive the tobacco, the other exit of the tube (90) being distant from the mentioned middle portion; a vertical separation duct (100) with its lower end communicating with a source of pressurised separation air (200)and with its upper end mounted to a curve of long radius (110) with a duct (100) being provided with a lower opening (130) for exit of the stems and portions of agglomerated tobacco; a closed separation chamber (150) with an upper entrance connected to the end of upper curve (110) of the duct (100) and a lower tobacco exit (151) communicating with the entrance to the machine, and a low pressure section (153) dislocated in relation to the upper entrance and to the lower exit and provided with an air duct and a air exhaust tube (210) with one end connected to the air exit duct of the low pressure section (153) and the other end connected to a means of moving the air (200).

28. A device according to Claim 27, CHARACTERISED by the fact that the conveying air flow communicates with the tobacco stream by means of a venturi (80) mounted on the feeding tube (90).

29. A device according to Claim 28, CHARACTERISED by the fact that the venturi (80) includes means for being blocked internally (83, 84) to control the current of conveying air through it.

30. A device according any one of Claims 27 to 29, CHARACTERISED by the fact that the source of pressurised conveying air is a fan (300).

31. A device according to any one Claims 27 to 30, CHARACTERISED by the fact that the side connection (140) of the separation duct (100) is sloped downwards and the separation duct is further provided with a sloped screen (120) inside the separation duct and has its lowest edge placed at the level of the lower edge of the stem exit opening (130) on one of the sides of the separation duct (100).

32. A device according to any one of Claims 27 to 31, CHARACTERISED by the fact that the low pressure section (153) of the closed air separation chamber (150) is separated from the rest of this chamber by a screen (155) which retains the particles of tobacco.

33. A device according to any one of Claims 27 to 32, CHARACTERISED by the fact that the air separator, air exhaust and the source of air separation are obtained from the same fan (200).

34. A device according to any one of Claims 27-33, CHARACTERISED by the fact that low pressure section (153) and the lower end of the separation duct (100) are interconnected to a fan (200) by exhaust duct (210).

35. A device according to any one of Claims 27-34, CHARACTERISED by the fact that it includes provision of a deflection plate (160) at least substantially flat and placed vertically dividing the inside of the separation duct (100) in half and transverse to the direction of the entrance of the tobacco stream which goes into the mentioned separation duct (100), with height, width and placing of the deflecting plate (160) planned in such a manner that it receives all the stem fragments and particles of tobacco which reach the centre portion of the separation duct when injected through the side feeder (140), deflecting these particles of material vertically upwards in the central portion of the ascending air flow stream in separation duct (100).

36. A device according to Claim 35, CHARACTERISED by the fact that the deflecting plate (160) extends over the whole width of the separation duct (100).

37. A device according to Claim 30, CHARACTERISED by the fact that the suction side of the venturi fan (300) is connected to the exhaust duct (210) by means of a duct (310).

38. A device according to Claim 27, CHARACTERISED by the fact that the separation duct (100) is mounted over the separation air fan and the fan is connected to a dust collection unit (250) through an interconnecting duct (240).

39. A process for tobacco particle metering and opening and separating of stems from a tobacco stream feeding a machine for packaging tobacco for sale, such as a cigarette manufacturing machine involving operations of air separation, metering and opening of tobacco and pneumatic separation of stem fragments as defined in any of Claim 1 to 7 and 19 to 27 respectively, CHARACTERISED by the fact that it entails steps of: separating the conducting air flow from the tobacco stream at a point distant from the tobacco reservoir; directing the tobacco stream to a first set of tobacco particle metering and opening rolls, submitting the tobacco stream to at least one of the first mentioned joint operations of metering and opening of the tobacco particles; carrying the metered and opened particle stream through a continuous flow of conducting air passing through a feeding tube and conducting it to a pneumatic stem fragment separation device; submitting the metered and opened tobacco stream to the mentioned operation of pneumatic separation of stem fragments; directing the stream of tobacco particles separately from the stem fragments to a second set of tobacco particle metering and opening rolls, submitting the tobacco stream to at least a second of the mentioned joint metering and particle-opening operations; and conducting the flow of metered and opened tobacco particles separated from one another, to the cigarette manufacturing machine.

40. A device for tobacco particle metering and opening and separating stems from a tobacco stream feeding a machine for packaging tobacco for sale, such as a cigarette manufacturing machine using devices for air separation, metering and opening the tobacco leaf and pneumatically separating stem fragment as defined in any one of the Claims 8 to 18 and 27 to 38, respectively, CHARACTERISED by the fact that it entails: a device (20) for separating the conducting air from the stream of tobacco coming from a reservoir; at least one of the first of the mentioned sets of apparatus for jointly metering and opening the tobacco particles (30, 40, 50, 60) receiving a flow of tobacco from the air separation device (20); a feeding tube (90) conducting a flow of conveying air communicating with the exit of tobacco particles from the mentioned first device for metering and opening (30, 40, 50, 60); one of the mentioned pneumatic stem fragment separation sets of apparatus (100, 200, 300) receiving a stream of metered and opened particles tobacco from the conducting tube (90), separating the particles of tobacco from the stem fragments, these leaving the tobacco exit; at least a second of the mentioned joint metering and opening sets of apparatus for tobacco particles (70, 40, 50a, 60a) with its entrance connected to the exit of the stem fragment pneumatic separation device and with its exit connected to the cigarette manufacturing machine.

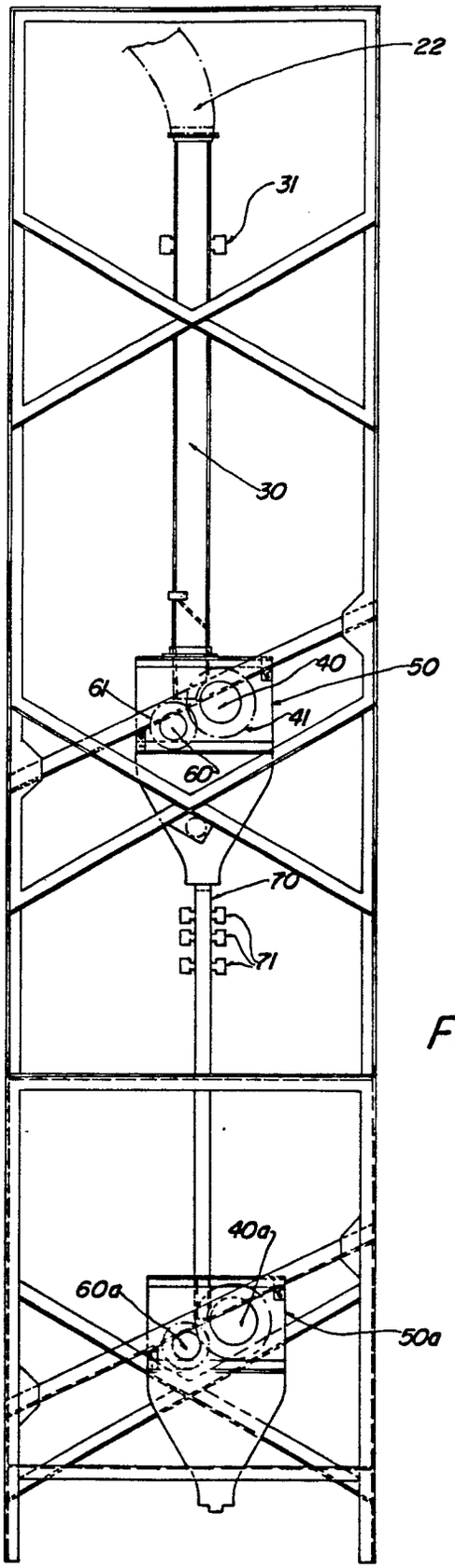


FIG. 1

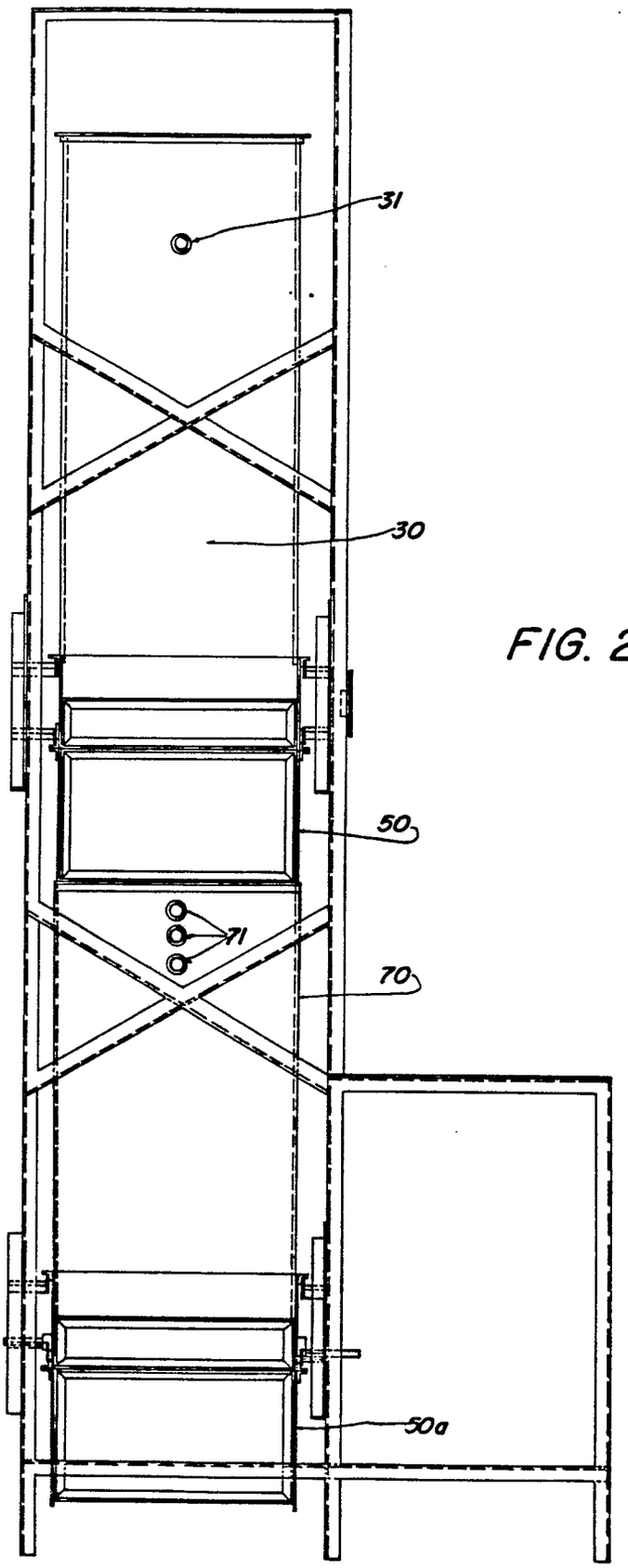
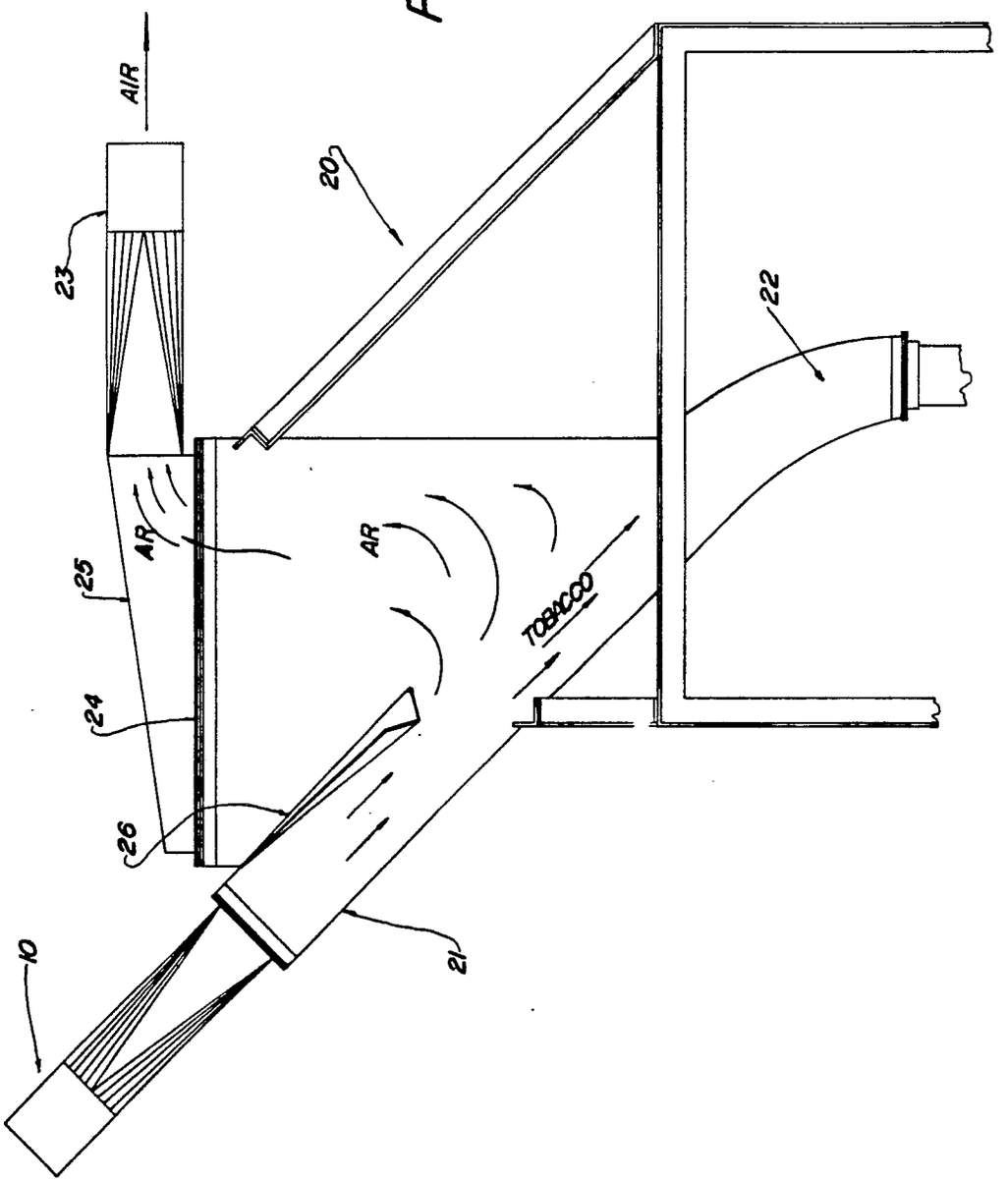


FIG. 2

FIG. 3



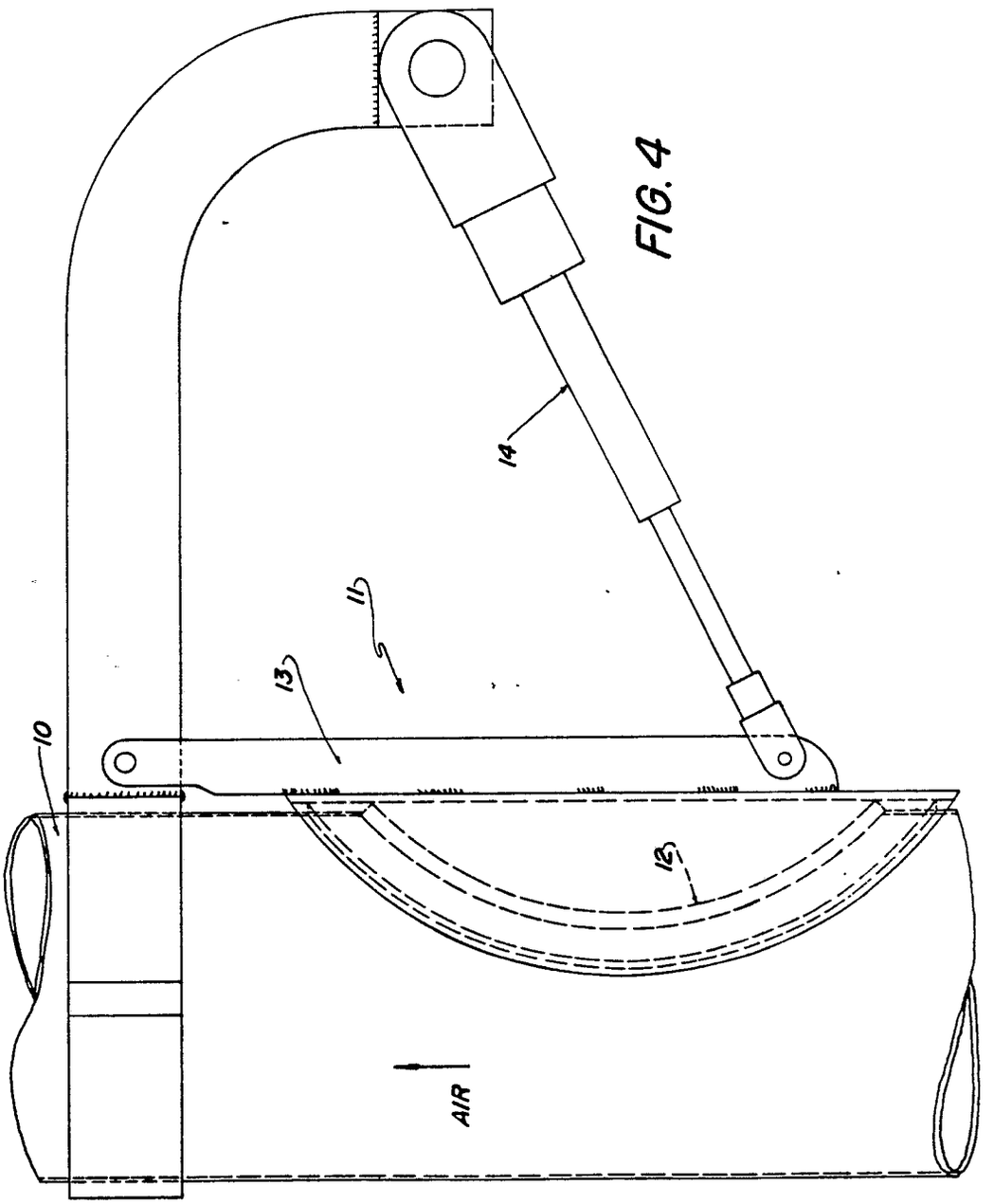


FIG. 4

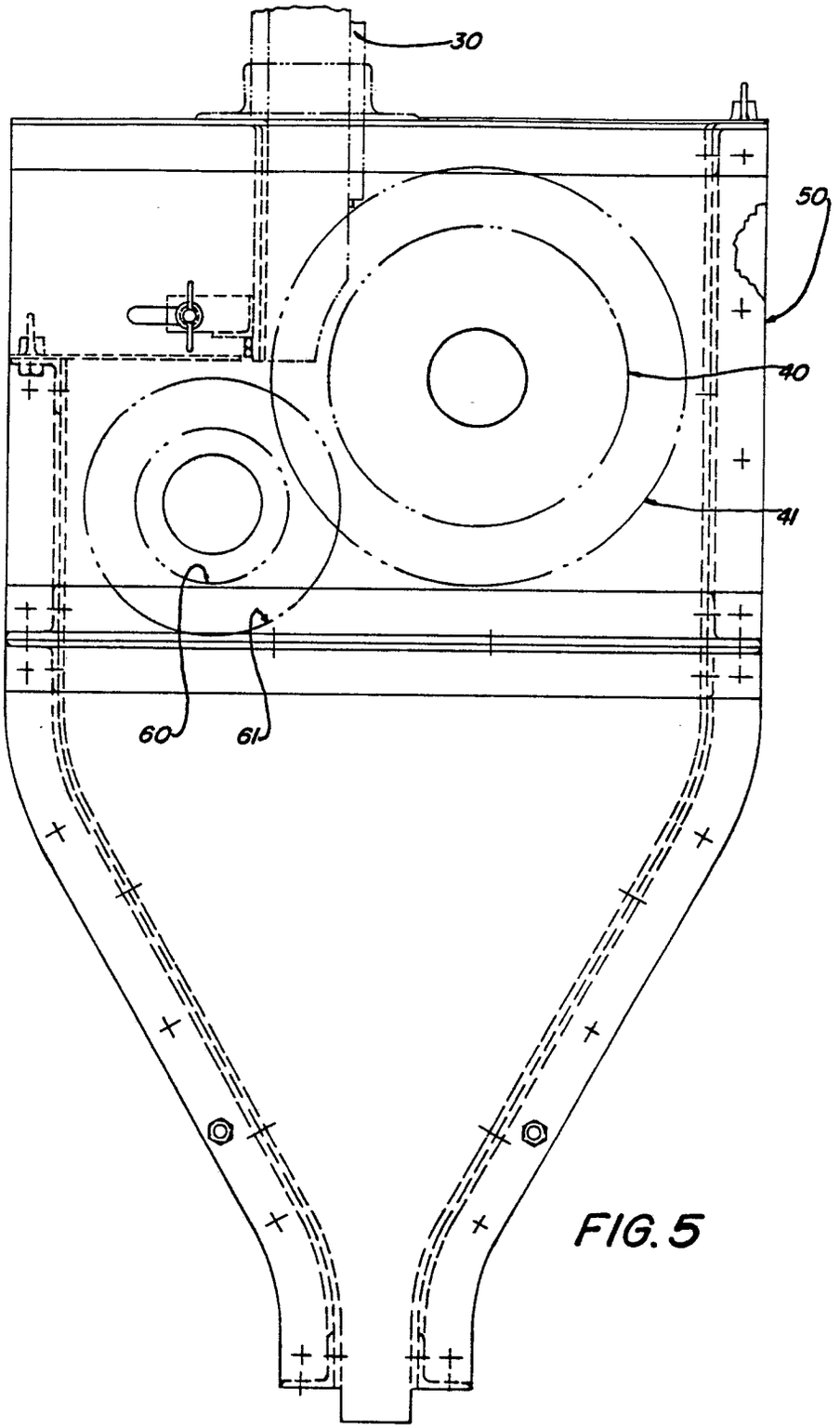


FIG. 5

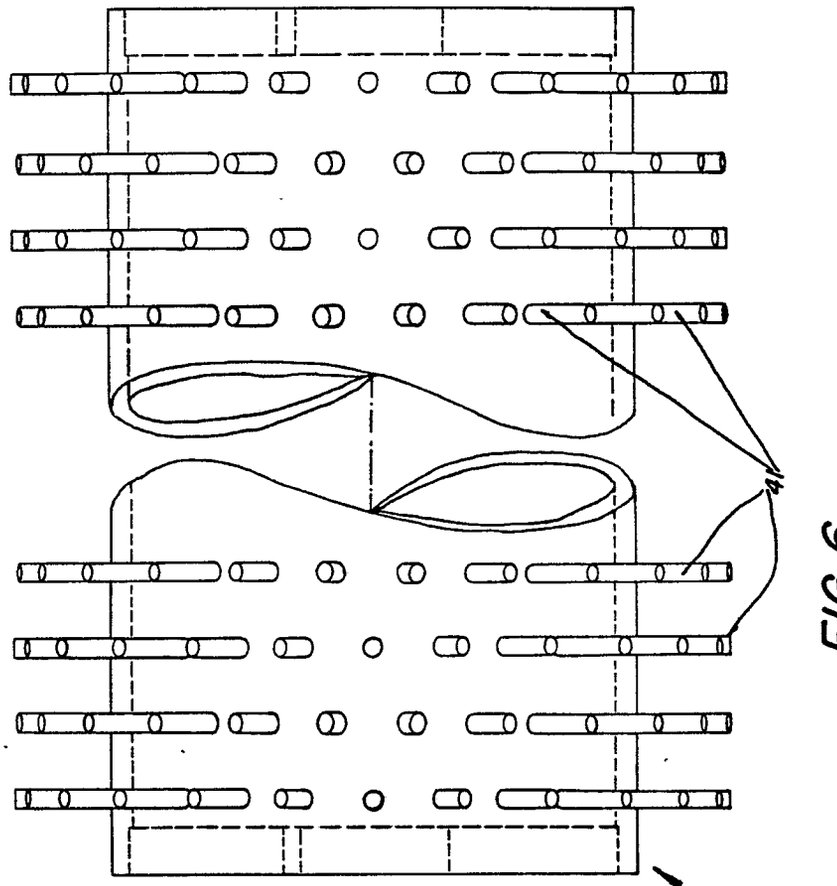


FIG. 6

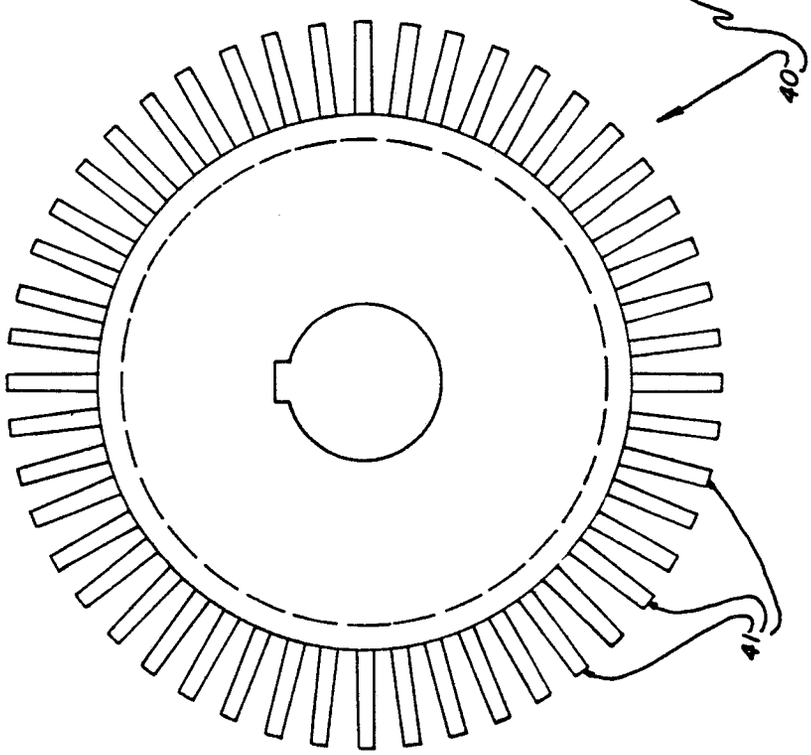


FIG. 6a

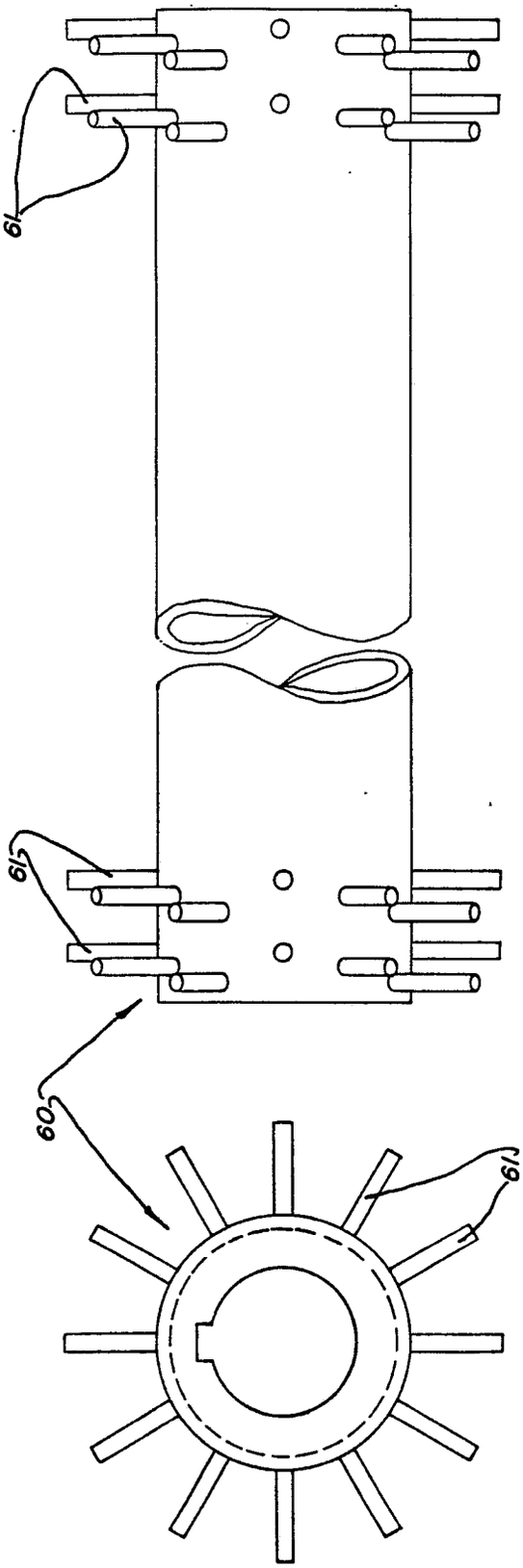


FIG. 7

FIG. 7a

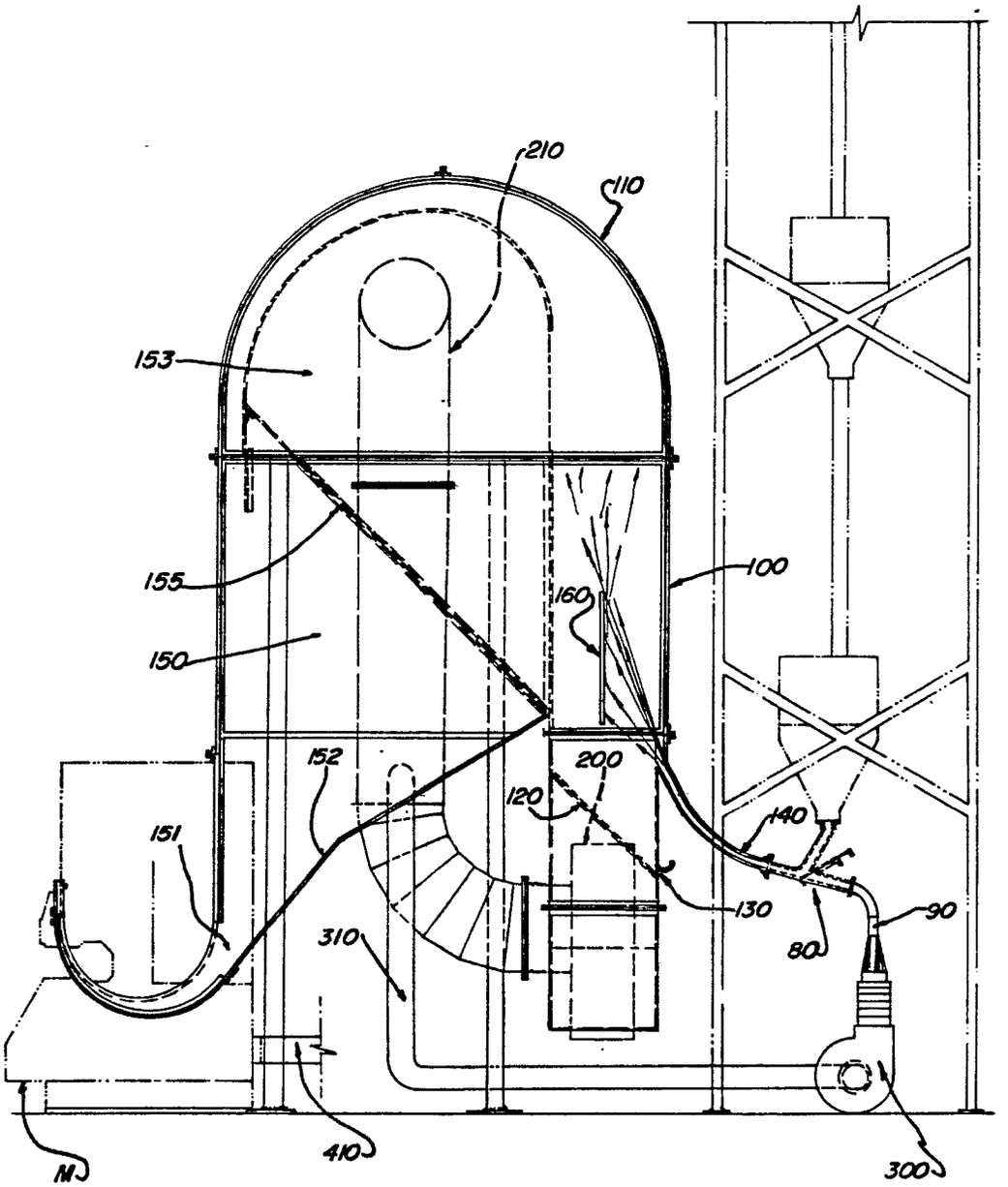

210
110
153
155
150
160
100
152
200
120
140
151
130
90
80
310
M
410
300

FIG. 8

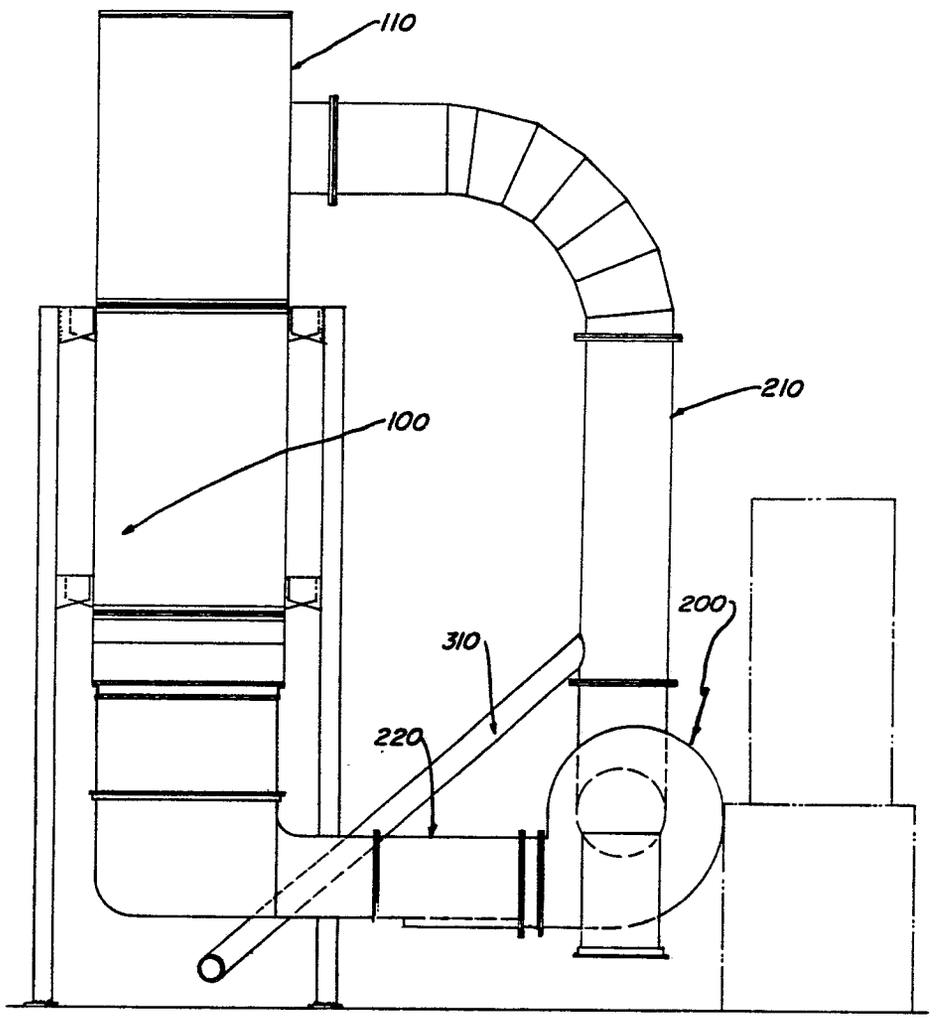


FIG. 9

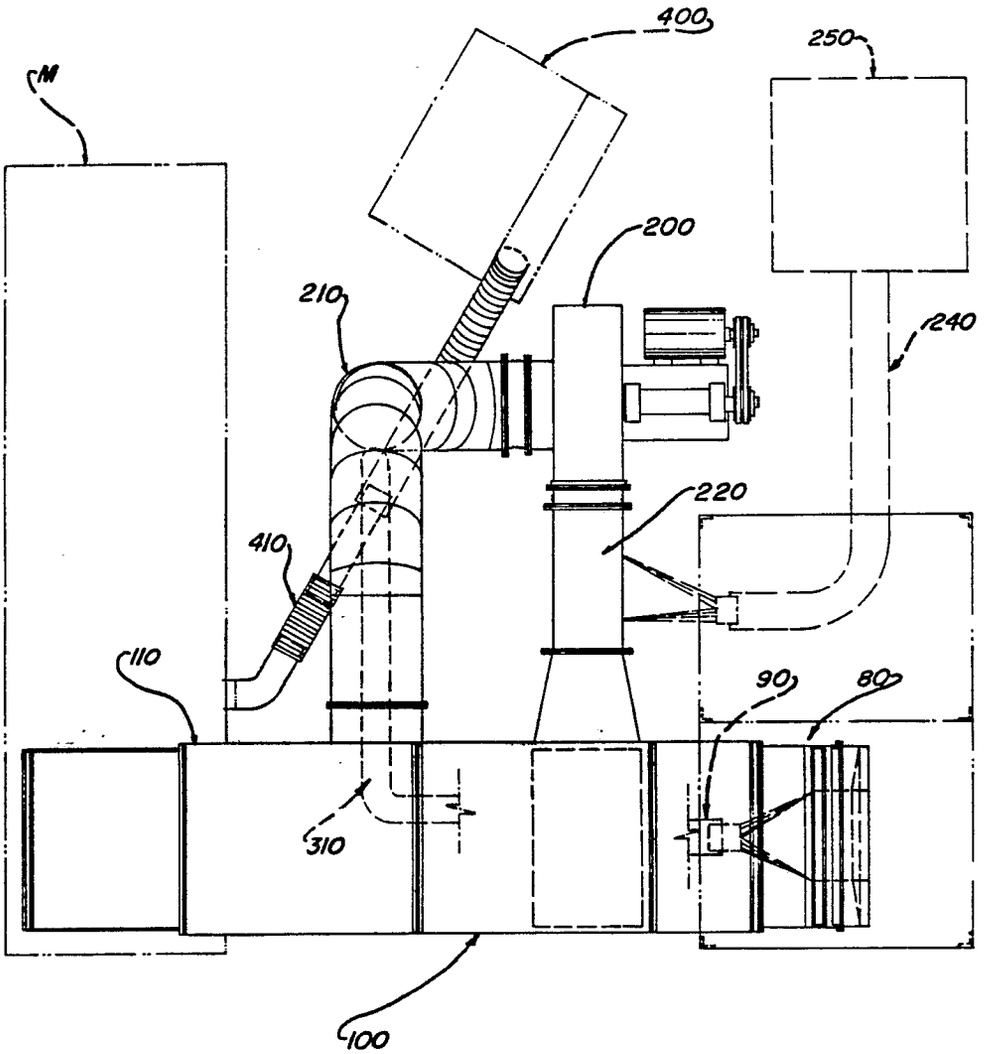


FIG. 10

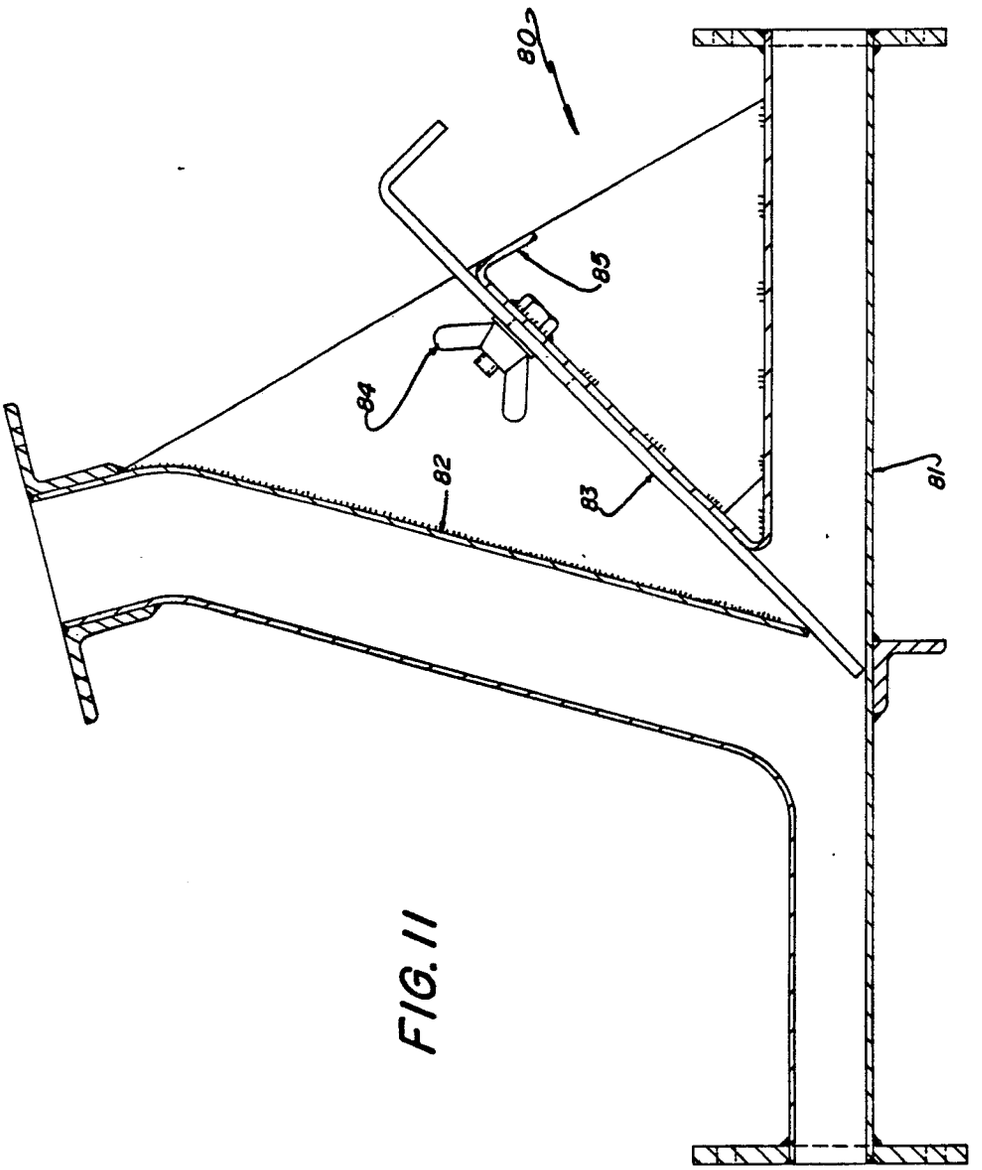


FIG. 11

FIG.12

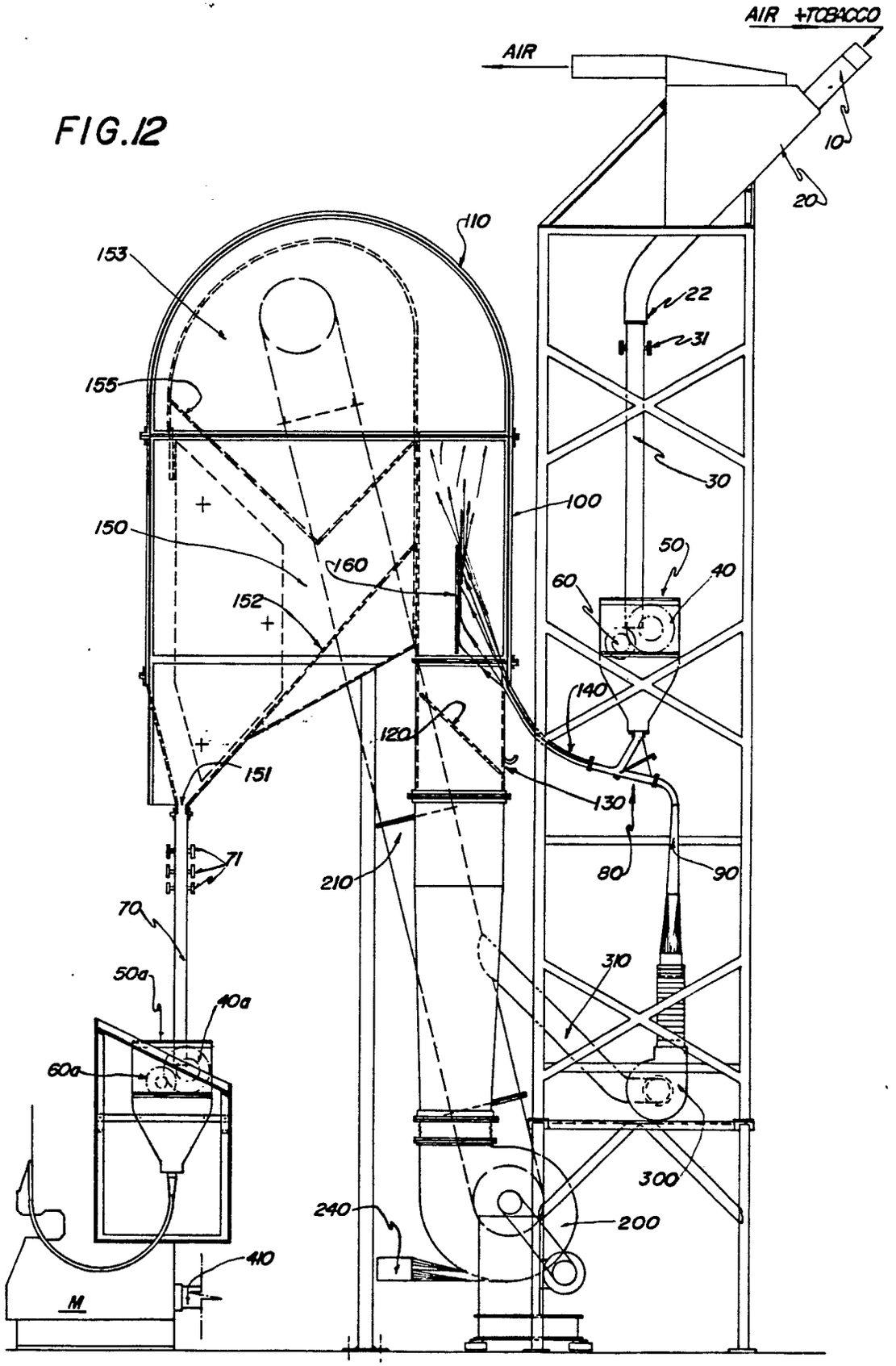
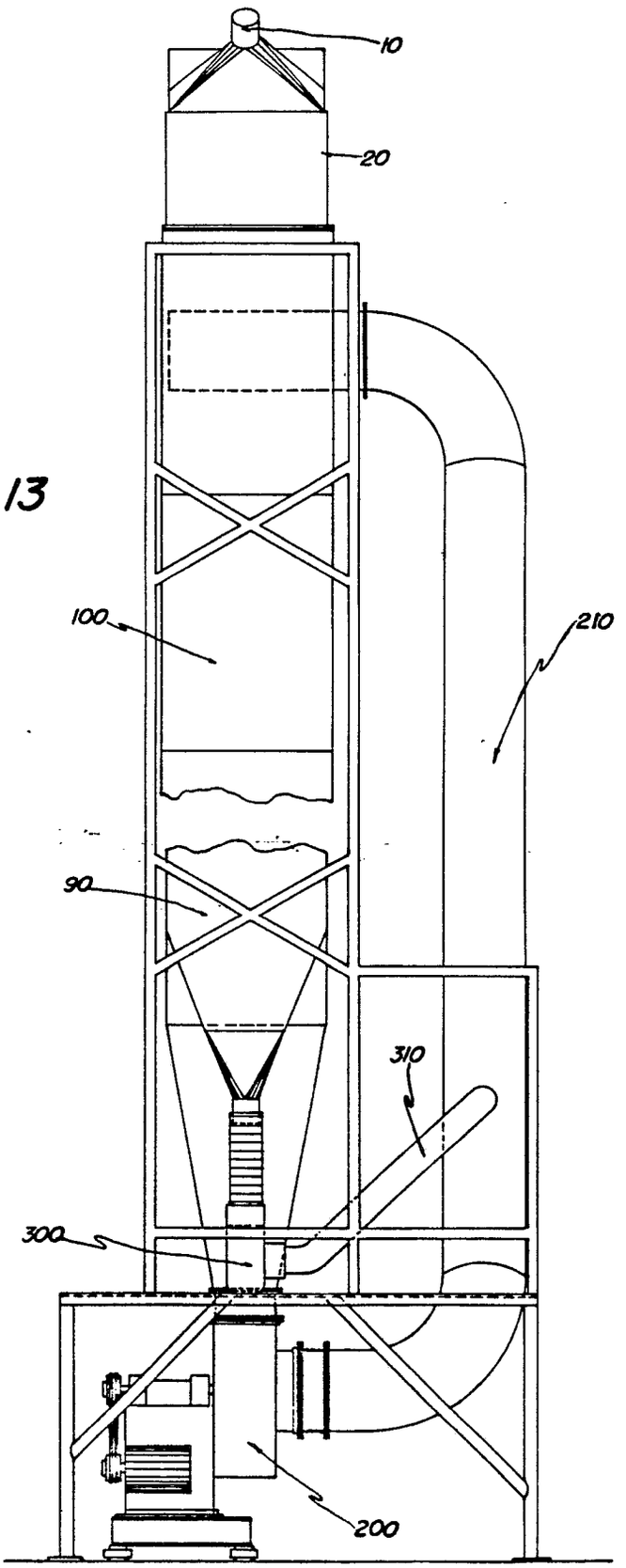

AIR +TOBACCO
AIR
10
20
110
153
22
31
155
30
100
150
160
50
40
60
152
140
120
151
130
71
210
80
90
70
310
50a
40a
60a
300
240
200
410
M

FIG. 13



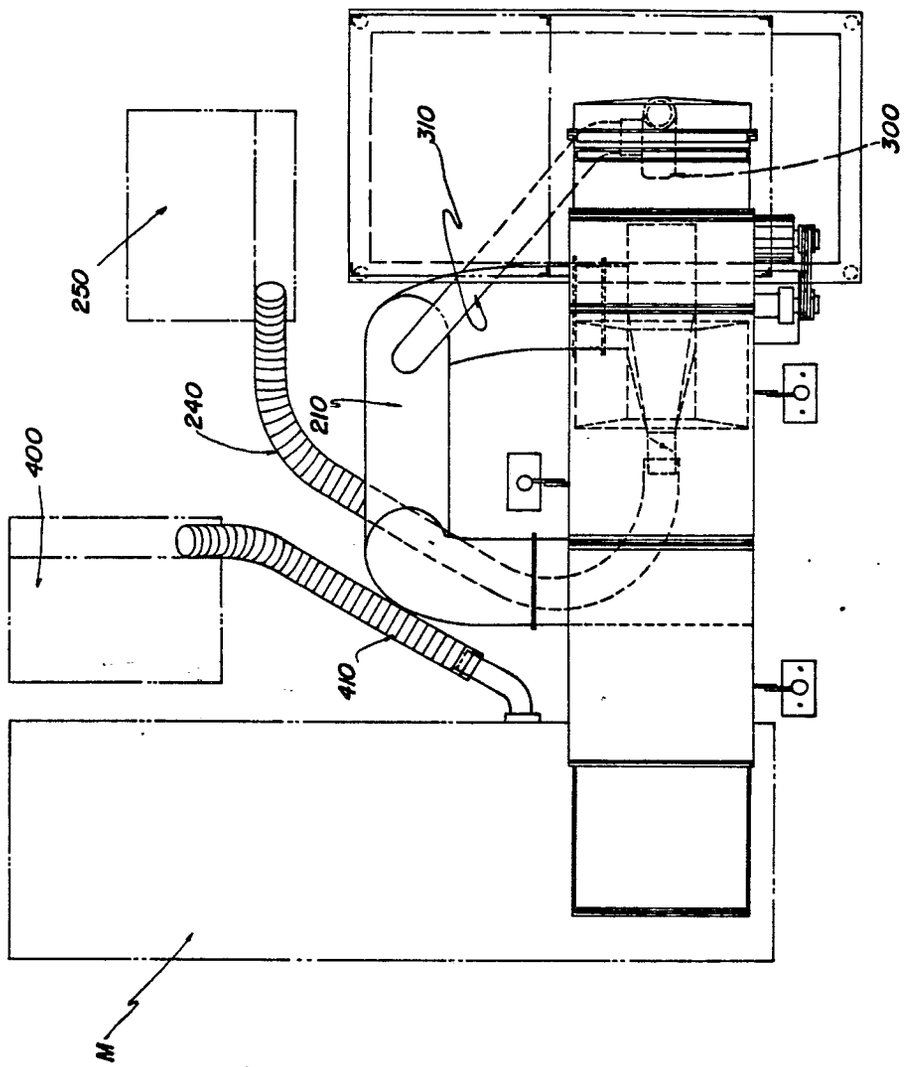


FIG. 14