Sept. 20, 1971 P. BUCHMANN ET AL 3,605,757
CONTINUOUS PROCESS FOR THE MANUFACTURE OF
REGENERATED TOBACCO
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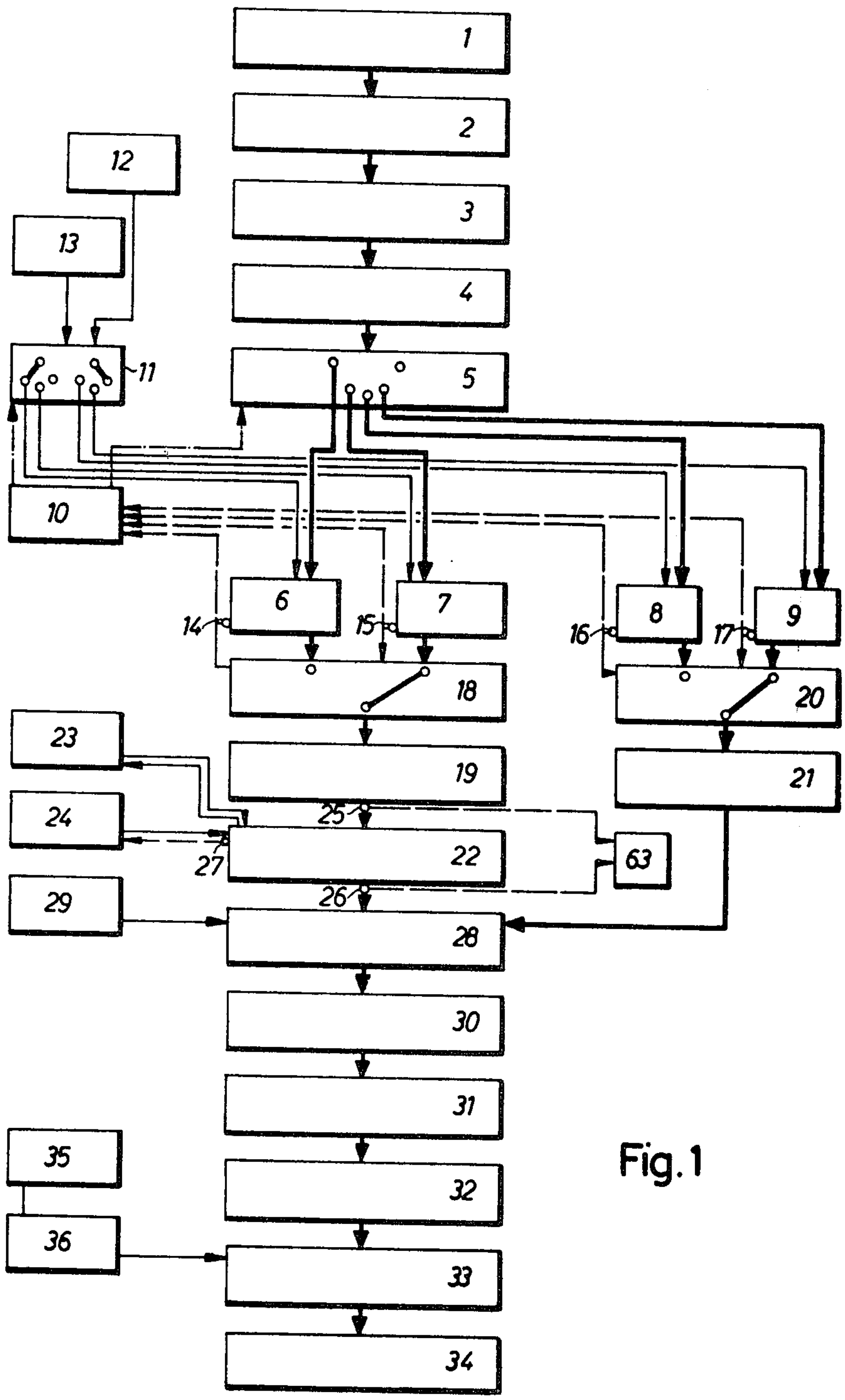

Fig. 1

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Fig. 2

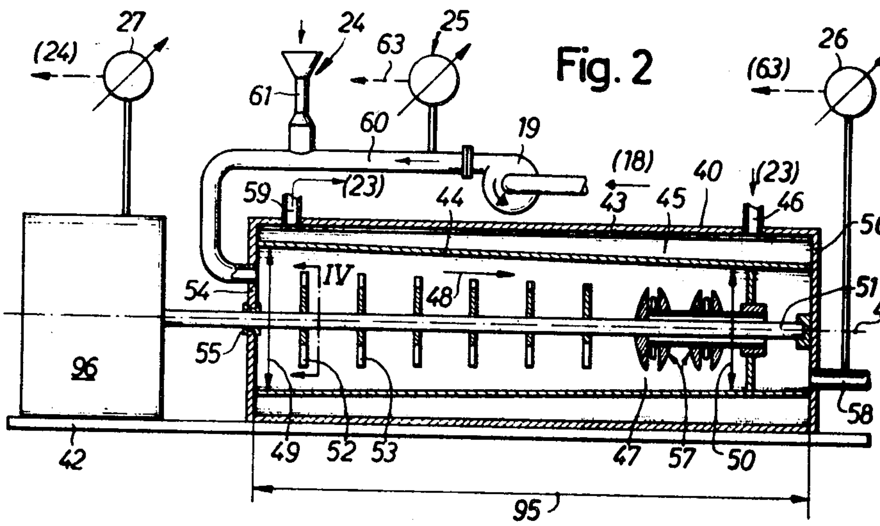
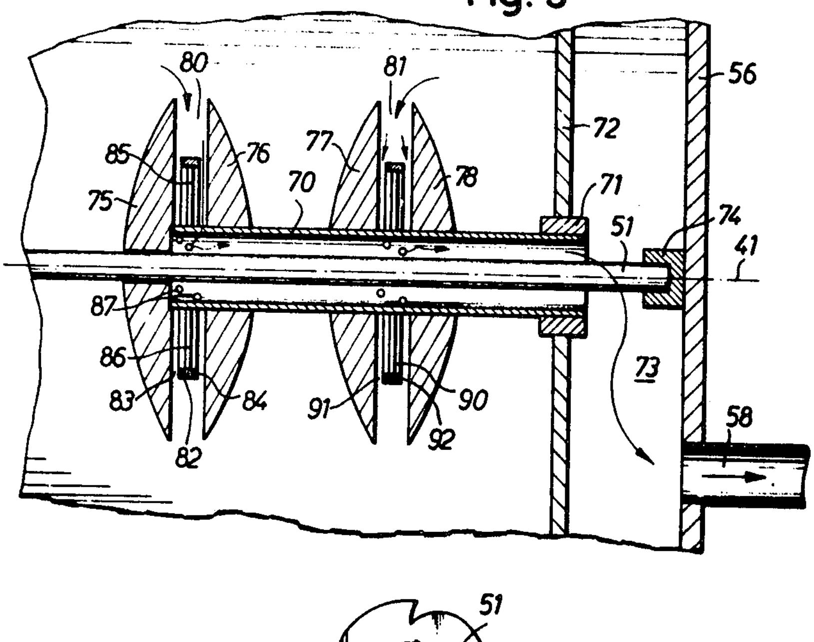


Fig. 3



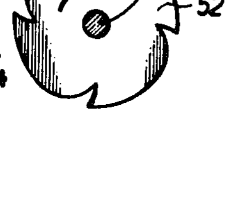


Fig. 4

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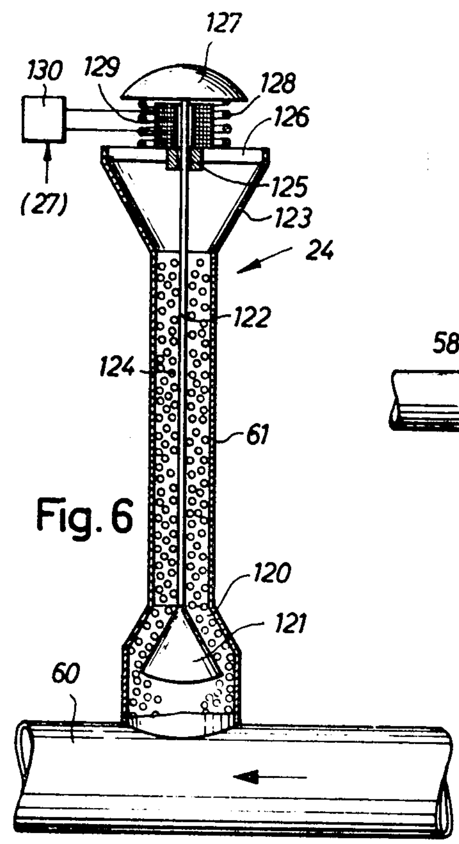


Fig. 6

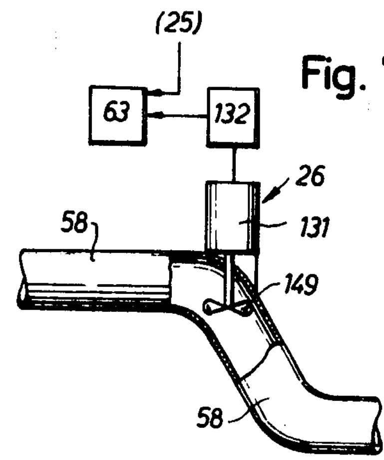


Fig. 7

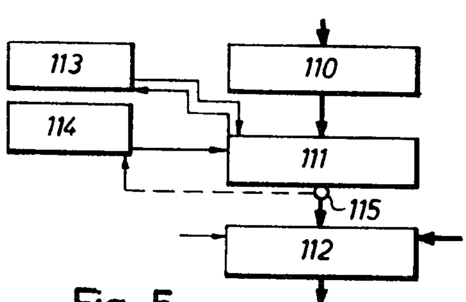
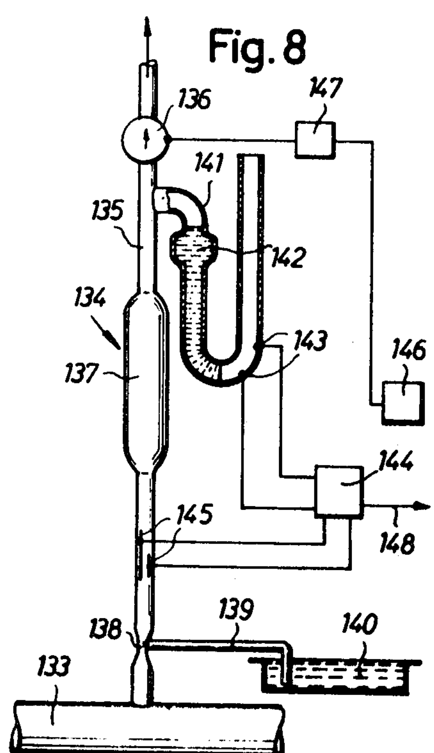


Fig. 5

Fig. 8



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3,605,757

CONTINUOUS PROCESS FOR THE MANUFACTURE OF REGENERATED TOBACCO

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U.S. Cl. 131—140 8 Claims

ABSTRACT OF THE DISCLOSURE

In order to manufacture regenerated tobacco, a mash is formed from reduced (pulverized) basic tobacco constituents. To this end, the reduced tobacco is admixed with a liquid to form a slurry which is forced through a glass grain body which is stirred at the same time. This homogenizes the slurry to form a mash. The glass grains are worn during the process. The glass grains which have been worn down to an unusable size are discharged from the body along with the tobacco mash. New glass grains are used to replenish the glass grain body continuously and thus make good the loss to the glass grain body caused by wear and removal of the unusable glass grains.

The present invention relates to a continuous process for producing a tobacco mash for the manufacture of regenerated tobacco, in which the finely divided basic tobacco and a liquid are continuously fed into a body of ground granular material which is continuously stirred, the ground material being filtered out of the body in the form of a homogeneous tobacco mash and to a device for implementing said process.

The tobacco mash obtained for example from tobacco leaf, for example in the form of waste products occurring during the manufacture of cigarettes, cigars and other tobacco products, is converted to the desired regenerated tobacco form, for example flake, fibre, strip, plug etc., and solidified by removing the water from it. In the tobacco mash, the binding agents present in the tobacco, for example pectin, are to a large extent activated or broken down. This process can be promoted by the introduction of chemical additives to the liquid. Insofar as the adhesion produced by the breakdown of these natural binders, may not be adequate on its own, other binders can be added to the liquid or to the tobacco mash. The binders inherent in the tobacco, will be broken down the better, the more finely the tobacco mash is ground. In this fashion, the addition of alien binders can be reduced to a minimum and this is something which is desirable in the interests of the smoking quality of the regenerated tobacco. Using a process of the kind introductorily described, it is possible to adequately finely grind tobacco mash while preserving the properties of the tobacco. However, in so doing, the grinding grains experience abrasion themselves and must be replaced when this happens. This can be carried out by interrupting the grinding process from time to time and substituting the worn granular body by a fresh charge.

The object of the present invention is so to contrive a continuous process so that the above mentioned interruptions can be avoided since, of course they impair the economic operation of the process.

The present invention of a process is characterized in that the grinding grains are ground down to a size corresponding to the filter pass size and are removed from the body along with the grain detritus and the tobacco mash; and that the material loss produced in the body

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as a consequence is compensated for by replenishing with grinding grains which are much larger than the ones passing through the filter. The term "filtering" used here and in the following, is intended to convey separation or selection in terms of particle size. The grinding grains used to replenish the body can be of cylindrical, spherical, ellipsoidal, polyhedral, lenticular or other regular solid form, or may for that matter be irregular in form. Preferentially the grains will have a spherical form however.

In accordance with the invention, the grinding grains which have been abraded down to an unusable size, are ground down still further until they can leave the body along with the tobacco mash. The invention in this context exploits the circumstance that grinding grains which have been reduced to a size such that they can pass the filter, do not, because of their small size, cause any disturbance. Experience has shown that in most cases it is possible to get away with about 0.3 to 1% by weight of detritus related to the weight of regenerated tobacco. Such a small quantity of granular substance does not appreciably impair the smoking quality of the regenerated tobacco, as experience has shown, this especially since it is quite readily possible by appropriately choosing the material of the grinding body, to ensure that the grinding grain substances entering the tobacco mash behave in an entirely neutral fashion during the further processing of the mash and during smoking of the regenerated tobacco produced therefrom. The materials used in the grinding body in this context may for example be glass or stone. The glass or stone detritus occurring in the mash, does not modify the basic constituents of the tobacco since leaf tobacco generally as a matter of course contains up to 15% by weight of silicates. Equally, synthetic materials are known which can be used for the grinding grains under the stated conditions.

When carrying out the grinding operation in known kinds of ball mills, grinding balls are provided in a rotating drum through which the material being ground passes. The balls are spun around the grinding space by rotation of the drum and in so doing break up the material. In contrast to this, in a stirred body of grinding grains, the material being ground is reduced in size predominantly by a crushing effect. In this context, a substantially larger effective area of the granular body is actively involved in the grinding action and this is something which is desirable in the present instance because of the effort towards a high throughput coupled with light treatment of the tobacco. The body can be placed in a vertical cylinder and stirred by an agitator mechanism rotating about the cylinder axis, the material being ground being forced through the body in the axial direction. The longer the transit length through the body, the finer the material will be ground and at the same time the heavier will be the pressure upon the bottom-most grains of the body. Too high a pressure at the latter point leads to structural breakdown in the tobacco with consequent impairment of the aroma, and also produces excessive wear in the mill and the grain body.

The object of a convenient further development of the invention is to avoid the development of extreme pressures inside the grain body. This further development is characterized in that the material to be ground is forced through the body in a substantially horizontal direction, the body layer height being substantially smaller than the horizontal transit distance within the body.

The method of the invention and the device used to implement same, will now be explained in greater detail making reference to the attached drawing.

FIG. 1 illustrates a flow chart for a process for the manufacture of a formed tobacco product, in accordance with the invention;

FIG. 2 is a schematic section through a stirrer-crusher mill for implementing the process of the invention;

FIG. 3 is a radically enlarger fragmentary view of FIG. 2;

FIG. 4 is a fragmentary view taken in the direction of the arrow IV on FIG. 2;

FIG. 5 is a fragment of a modified flow chart;

FIG. 6 is a glass ball distributor for a stirrer-crusher mill of the kind shown in FIG. 2;

FIG. 7 is a viscosity meter for a stirrer-crusher mill of the kind shown in FIG. 2; and

FIG. 8 is a granulometer for a stirrer-crusher mill of the kind shown in FIG. 5.

In FIG. 1, the individual boxes each represent one or more process stages or the associated device. The full-drawn connecting lines between the individual boxes indicate the material flow, the flow in each case being in the direction indicated by the arrow. The broken-lines are metering lines along which the measured results are transmitted in the direction of the appropriate arrows. The chain-dotted lines are control lines through which the commands are transmitted likewise in the direction of the arrows.

The box **1** is a tobacco silo in which for example natural tobacco, but preferably tobacco scrap, is collected. From the silo **1**, tobacco passes to a mill **2** where it is fine-ground to a particle size in the order of between 5 to 100μ. The mill **2** will preferably take the form of an impact pulverizer. The ground tobacco has the sand removed from it at the stage indicated by box **3** and at stage **4** is intermediately stored in a silo **4**. The operation of sand removal is not absolutely essential. Grinding and removal of sand can be carried out in a continuous operation but batch operation is equally possible. From the intermediate silo **4**, a distributor **5** is supplied and this in turn feeds batches of ground tobacco from the intermediate silo to two stirrer mechanisms **6**, **7** and two flotation devices **8**, **9**. The supplying of the stirrer mechanisms **6** and **7** and the flotation mechanisms **8** and **9**, is effected in a successive way, in other words at any one time only one of these devices will be supplied. To this end, the distributor **5** contains a switch arrangement by means of which distribution to one of the said devices **6** to **9** can be effected in an arbitrary way. The switch arrangement in the distributor **5** is controlled by a control unit **10**. The latter also controls a switch arrangement associated with a liquid dispenser **11**. Connected to this liquid dispenser are water reservoir **12** and a solvent reservoir **13**. Through the liquid dispenser, the output lines from which pass to the stirrer mechanisms **6** and **7** and the flotation devices **8** and **9**, and under the control of the switch arrangement, a portion of solvent is fed into the stirrer mechanisms **6** or **7** or a portion of water into the flotation device **8** or **9**, whenever tobacco is distributed to the relevant devices. The quantity of liquid introduced is set in the liquid dispenser to accord with the size of the tobacco proportion which is dispensed at the same time by the tobacco distributor **5**. The reference **14** is a filling level indicator for the stirrer mechanism **6**, **15** is a filling level indicator for the stirrer mechanism **7**, **16** is a filling level indicator for the flotation device **8**, and **17** a filling lever indicator for the flotation device **9**. These indicators **14** to **17** in each case produce a signal whenever the relevant device is empty or virtually so. This signal is supplied via a corresponding control line to the control unit **10** and there triggers a control command in the following manner. If the stirrer mechanism **6** is empty, then the control unit switches the two distributors or dispensers **5** and **11**, in such fashion that a portion of tobacco is supplied to the mechanism **6** along with a portion of solvent. When this has happened, the two distributors are switched off again. The same happens when the stirrer mechanism **7** is empty. If one of the flotation devices **8** or **9** is empty, then a portion of water and a portion of tobacco are fed into it. If one of the devices **6** to **9** is empty, while another one

is being filled, then the corresponding pulse from the level indicator is stored in the control unit until such time as the operation has ended, and the relevant filling operation is only initiated when the immediately preceding one has terminated. Thus, at any one time only one of the devices **6** to **9** is being filled. With each dispensing or distributing operation, the tobacco distributor for the stirrer mechanisms **6** and **7** releases the same preset quantity of tobacco. Also, in respect of the two flotation devices **8** and **9**, too, it releases the same preset quantity of tobacco with each distribution operation. The tobacco quantity supplied to a stirrer mechanism each time, can be the same as that supplied to a flotation device **8**, but may equally well differ for that matter.

The quantity of liquid which is supplied by the dispenser on each occasion, is always the same for both stirrer mechanisms **6** and **7** on the one hand, and on the other is always the same for both flotation devices **8** and **9**. Preferentially, this quantity will be so contrived that in the stirrer mechanisms and flotation devices a thin mesh (slurry) is produced.

The stirrer mechanisms **6** and **7** and flotation devices **8** and **9** are continuously operating devices so that the supplied mixtures are continuously stirred and flotated. The liquid introduced can be heated. Where the solution is concerned, it is a weak basic or acid solution having a pH value somewhere between 7.5 and 10 which is involved. The dissolved substances will preferentially take the form of potassium hydroxide, potassium carbonate or polyphosphates. Other substances can be used in the solution, but substances which will produce toxic or injurious components in the smoke of the final tobacco product, e.g. hydrogen sulphide, ferrocyanide, nitrous amines or carbonmonoxide in dangerous quantites, must be avoided. A mixture ratio of 1 kg. of tobacco to between 3 and 6 l. of liquid in the charging of the stirrer mechanisms and flotation devices, has been found to be suitable and leads to a mash which is readily amendable to further processing.

The two stirrer mechanisms **6** and **7**, as well as the two flotation devices, are connected in parallel and serve to supply the ensuing process equipment in an alternating way so that the ensuing operation is a continuous one. The alternating operation of the stirrer mechanisms **6** and **7** can also be united in a single stirrer mechanism. To the same end, it is equally possible to connect in parallel more than two stirrer mechanisms **6** and **7**. The same applies to the flotation devices **8** and **9**.

From the stirrer mechanisms **6** and **7**, the mash is supplied to an automatic switch arrangement **18** and thence passes to a continuously operating dosing pump **19**. The switch arrangement **18** can occupy two functional positions. In the one shown in the drawing, the output of the stirrer mechanism **7** is connected to the input of the dosing pump **19** and the output of the stirrer mechanism **6** is shut off. In the other position, the output of the stirrer mechanism **6** is connected to the dosing pump **19** and the output of the stirrer mechanism **7** is shut off. The switch arrangement **18** operates automatically and is controlled in fact by the pulses from the filling level indicators **14** and **15**. As soon as the indicator **15** shows that the stirrer mechanism **7** is empty, being in the position shown in the drawing, then the switch arrangement changes into the other position connecting the stirrer mechanism **6** to the dosing pump **19** until the level indicator **14** produces a signal to the effect that the stirrer mechanism **6** is empty. The switch arrangement **18** then changes over again to the stirrer mechanism **7** which has now been refilled with material. In order that when one stirrer mechanism is empty, the other shall already be full of stirred material, the distributor and dispenser arrangements **5** and **11** are so designed that it requires substantially less time to fill a stirrer mechanism than it does to discharge same using the dosing pump **19**. The same applies to the flotation devices **8** and **9** which are discharged across a switch arrangement 20 through a dosing pump 21. The switch arrangement 20 corresponds in its function to the switch arrangement 18 and is operated by the measuring pulses coming from the level indicators 16 and 17. In the position shown in the drawing, the flotation device 9 is being discharged across the switch arrangement 20 and as soon as the level indicator 17 shows that the flotation device 9 is empty it will change position and discharge the flotation device 8, and so on. From the dosing pump 19 which is continuously in operation and at all times produces the same mash delivery rate, an uninterrupted stream of mash flows into an ensuing stirrer-crusher mill 22 filled with glass balls, the design of which is illustrated in detail in FIGS. 2 to 4 and will be explained hereinafter. In this stirrer-crusher mill, the tobacco particles in the dry are crushed and converted virtually to a colloidal size. In this crushing operation, heat is developed and for this reason the stirrer-crusher mill 22 is connected to a cooling device 23 from which a cooling jacket associated with the stirrer-crusher mill is supplied with a flow of coolant, possibly in a continuous manner. The glass balls inside the stirrer-crusher experience wear during operation and ultimately become so small that they are no longer suitable for the crushing function it is desired to achieve. The tobacco mash processed in this way evenutally leaves the stirrer-crusher mill together with glass balls which are below a certain size and can pass a filter located at the discharge side. The supply of glass balls inside the stirrer-crusher mill, which are continuously diminishing in size, is continuously made up from a glass ball dispenser 24 so that there is no need to interrupt operation in order to open the stirrer-crusher mill and exchange balls which have become unusable. The glass balls which are supplied by the dispenser 24 in order to make up the loss from the glass ball body, are many times larger in diameter than the glass balls which have become unusable through wear and which can pass out through the discharge filter along with the tobacco mash. At the intake and discharge sides viscosity meters 25 and 26 are connected to the stirrer-crusher mill 22, and these measure the viscosity of the inflowing and outflowing mash. Also, the stirrer-crusher mill is fitted with a dynamometer 27 in order to continuously measure the power absorbed by the stirrer. The metering pulses from the dynamometer 27 are supplied to the glass ball dispenser and there control the distribution of the glass balls, the latter being a continuous function and the quantity at all times being such that the particular degree of wear is just made good. The viscosity meters 25, 26, are connected to an alarm system 63.

Coarse sand grains are also reduced in size in this glass ball stirrer-crusher so that in some cases it is possible to dispense with the sand removal operation 3. The discharge filter is so designed that glass balls or sand grains can only leave the stirrer-crusher mill when they have been reduced to a size such that they no longer constitute a nuisance in the final tobacco product. If, as in the example, a tobacco flake is going to be produced and this is to have a thickness of about 1/10 mm. in the finished condition, then the filter size can be set to about 3/10 mm. without there being any appreciable proportion of grains which can leave the stirrer-crusher 22 and interfere with the finished flake. The colloidally fined mash, in which the pectins present in natural tobacco have largely been broken down and rendered adhesive, passes to a mixer 28 which is also supplied uniformly with tobacco slurry from the flotation devices 8 and 9, by the dosing pump 21. The dosing pump 21 operates continuously and at a uniform delivery rate. Also, an auxiliary dispenser 29 continuously feeds additives into the mixer. This latter function is involved with the continuous addition of binders and of softener chemicals, chemicals for improving tear resistance, chemicals for improving burning quality and chemicals for improving the moisture-resistance of the finished flake. The said additives are not absolutely essential but are expedient in many cases. Preferential binders are carbethoxy methylcellulose derivatives. In the mixer 28 two tobacco mashes are mixed with one another. One mash has passed the stirrer-crusher mill and the other has merely been flotated. If all the tobacco is fed through the stirrer-crusher mill, i.e. if the branch of the system containing the flotation devices 8 and 9 is closed off, then relatively little binder is needed since virtually all the binders present in the tobacco will have been broken down by the stirrer-crusher mill and the added solutions. In such instances, binder additives in the order of magnitude of 0.5 to 1.5% by weight related to the tobacco flake weight, will suffice. However, if part of the tobacco is merely flotated, then it is advisable to introduce somewhat larger binder quantities (up to about 2% by weight related to the tobacco flake weight).

The mixed mash, with the additives introduced into it, passes from the mixer 28 to the homogenizer 30. In the homogenizer 30, any coarser grains which are still present, for example sand grains or reduced glass balls, are further reduced. The homogenizer 30 can be omitted if the filter at the output of the crusher 22 only allows grain sizes to pass which will actually be acceptable in the finished product, or if these grains are subsequently removed by a selective process. From the homogenizer 30, the mash passes to a spreader 31. There, it is spread out on a moving steel belt, in a thickness in the order of magnitude of about 1 mm. The steel belt then passes through a dryer 32 where the spread tobacco mash is dried to leave it with a certain residual plasticity, the mash adhering together through the medium of the natural and additive binders which have been broken down, and thus forming a solid sheet (flake). The steel belt then passes through a humifidier 33 in which the formed sheet is sprinkled with water or sprayed with steam from a reservoir 36 to which, if required, chemical additives can be added from a dispenser 35. This remoistens the sheet somewhat and makes it easier to remove it from the steel belt in a separator 34.

The stirrer-crusher mill exhibits a cylindrical housing 40 arranged upon a plate 42 with the cylinder axis 41 horizontal. The wall of the housing is a double one and the external wall is marked 43, the internal one 44 so that an annular cavity 45 is left and this is connected through an intake connection 46 and a discharge connection 47 to the cooling device 23 shown in FIG. 1, cooling water flowing through the said cavity in operation as required. The grinding space 47 defined within the internal wall 44, tapers in the transfer direction indicated by arrow 48. The diameter 49 of the grinding space at the upstream end is between 1 and 15%, preferably around 1.5%, larger than the diameter 50 at the downstream end. The diameter 49 is a fraction, about 1/3 to 1/5, of the length 95 of the grinding space. The capacity of the grinding space 47 will for example amount to about 15 l. Along the cylinder axis 41 a grinding shaft 51 is rotatably mounted inside the grinding space, upon which six grinding discs 52, 53 are assembled. The shape of the grinding disc 52 is shown in FIG. 4 the other grinding discs being geometrically similar but having smaller diameters. The shaft is taken outside at the intake end 54 to a pressure-tight and liquid-tight gland 55 and connected to an electric motor 96 the power consumption of which is continuously measured by the dynamometer 27. The data from this dynamometer are supplied to the glass ball dispenser 24. The other end of the shaft is journalled inside the grinding space 47 at the opposite end wall 56. On this end of the shaft, a filter arrangement generally marked 57, is mounted and this will be described in detail in relation to FIG. 3. Through this filter arrangement, the material leaves the grinding space for the discharge connection 58 whence it flows through the viscosity meter 26 to the mixer 28. The dosing pump 19 of FIG. 1 has been indicated again in FIG. 2. It pumps the mash through a line 60 which opens into the grinding space at the end wall **54**. Branching into this line **60** through a pressure lock **61**, is a line coming from the dispenser **24** supplying the glass balls. Also connected to the line **60** is the viscosity meter **25** which continuously measures the viscosity of the mash supplied. In operation, the grinding space is filled up to about 90% with glass balls. Instead of glass balls, it is also possible to use balls or granules of other material. The prerequisite in the contex is that these balls should crush the tobacco material and that the detritus passing into the tobacco as a consequence should not be made of materials which would be undersirable be in the finished tobacco product. These conditions are satisfied by quartz glass balls. The glass balls continuously supplied through the dispenser, have a diameter of about 3 mm. The filter device **57** is so designed that the glass balls which have been worn down to a diameter of less than 0.3 mm., can leave the stirrer-crusher mill along with the tobacco mash. Experience has shown that the incidence of glass detritus can be reduced to below 1% by weight related to the weight of the finished flake or sheet. Replacement glass balls are supplied in corresponding quantities by the dispenser. The particular requirement in terms of replacement glass balls is determined from the power consumption of the stirrer mechanism, this power factor being continuously measured by the unit **27**. If the power consumption falls off, then this indicates a deficiency of glass balls unless the tobacco material has developed an unusual viscosity because of some malfunction of the system. These cases are indicated, however, by the measuring devices **25** and **26** which are therefore connected to the alarm device **63**. An alarm is triggered when the measured viscosity lies outside predetermined limits. In operation, the shaft **51** rotates and carries with it the discs **52**, **53**, these continuously circulating the glass balls in the otherwise fixed mill housing **40**, and thus crushing the mash and its tobacco constituents, as same flows through. The mash is forced through the grinding space **47** by the dosing pump **19**. The pumping action is further reinforced by the discs **52**. The taper of the internal wall **44** has been found expedient where the indicated object is concerned. It is particularly advantageous that because of the horizontal arrangement of the crusher, the height of the glass ball body or filling is not as high as it would be if the same crusher were operated vertically. This means in other words that the pressure developed on the glass balls at the bottom of the grinding space is not so high. This, in turn, is in the interests of the desired light treatment of the tobacco particles while at the same time achieving a high throughput and reducing the wear in the stirrer-crusher mill mechanism. The crushing operation can in this arrangement be distributed over a very long length and all that is required in this context is to design the stirrer-crusher to be appropriately long; unlike the case of the vertical crusher, this ensures that the bottom-most glass balls do not have to support the pressure of a high glass ball head.

The filter arrangement consists of a tube section **70** which is fitted coaxially onto the end of the shaft **51** and is independently mounted in a liquid-tight bearing **71**. The bearing plate **72** of bearing **71** defines in relation to the end wall **56** a space **73** from which the discharge connection **58** extends and in which the bearing **74** for the end of the shaft **51** is housed. The other end of the tube section **70** is secured against rotation on the shaft **51** by means of a split ring assembled on said shaft, so that it (the tube **70**) rotates along with said shaft **51**. The tube section **70** also carries three further split rings **77**, **78**, each of which is cylindrical and symmetrical in relation to the axis **41** of the cylinder, the said split rings being arranged in pairs to define slots **80**, **81**. Those sides of the split rings which delimit the slots, are of plane-parallel design. They can also be provided with fluting and similar formations. Within the slot **80**, a bush **82** is arranged coaxially to the axis **41** of the cylinder, the bush leaving a clearance of about 0.3 mm. at each end to form an annular gap **83**, **84**, in each case. The bush **82** is secured to the tube section **70** through radial spacers **85**, **86**. The tube section **70** is interrupted in the neighborhood of the gap **80**. One such interruption is marked **87**. The diameter of these interruptions or openings is greater than 0.3 mm. In the gap **81**, a correspondingly designed bush **90** is provided and this likewise leaves two equal annular gaps **91**, **92**, namely 0.3 mm. in width in each case. In the neighborhood of the gap **81**, the bush is also interrupted. After it has flowed through the entire glass ball body in the direction of the arrow **48**, the tobacco mash passes into the neighborhood of the gaps **80**, **81** and is there imparted a rotational movement as a consequence of the rotation of the split rings. As a consequence of the resultant centrifugal force developed, glass balls which have not yet suffered heavy wear are separated out at an earlier stage and move out radially. The mash then moves on, along with smaller glass balls or glass grains, into the neighborhood of the annular gaps **83**, **84**, **91**, **92**. The mash can flow through these annular gaps as also can glass balls which have been reduced to 0.3 mm. diameter or less, and are therefore unusable. The mash, along with these unusable glass balls, flows through the openings into the interior of the tube section **70** and then into the space **73** from which it is discharged. It is worthy of note here that several annular gaps **83**, **84**, **91**, **92** responsible for the filtering action, are arranged in parallel so that an adequate throughput is achieved even at the small gap width involved. The small gap width is desirable in order that only glass balls of a size which render them unusable for the grinding operation and which is compatible with ensuing processing, can actually pass through. At a gap width of 0.3 mm. as indicated here, it is possible to dispense with the homogenizer **30**. When using the homogenizer **30**, the gap width can be made a little larger. The pair of split rings **77**, **78** can be dispensed and the corresponding openings for the gap **81** in the tube section **70**, can be closed off. Then, the material can only exit through the two annular gaps **83**, **84**. In many cases, this will be quite adequate. Obviously, instead of two pairs of gap-defining split rings, even more can be provided in order to reduce the flow restriction.

In modification of the example illustrated, it is possible to arrange between a pair of split rings not simply one bush (e.g. the brush **82**), but two or more and indeed such a fashion that between each two bushes an additional annular gap, preferably of the same size throughout, is formed. This artifice too will facilitate discharge of the material.

In both cases, by increasing the numbers of gaps in situations where facilitating the discharge flow is not an essential, the gap width can be reduced and this means that only glass grains of correspondingly small size will be allowed to pass.

It is particularly noteworthy that the process in accordance with the invention can be operated continously following the stirrer mechanisms **6**, **7** and the flotation devices **8**, **9**. If a single stirrer-crusher mill **22** does not have adequate capacity in relation to the other devices, then several of these can be operated in parallel. If the intensity of crushing in this kind of stirrer-crusher mill is inadequate, then several such mills can be connected in an in-line arrangement.

In FIG. 5, the reference **110** indicates a dosing pump corresponding to that **19** of FIG. 1, this dosing pump supplying tobacco mash to a stirrer-crusher mill **111** corresponding to that of **22**.

The ground tobacco mash passes from the stirrer-crusher mill **111** to a mixer **112** corresponding to that of **28**. The stirrer-crusher **111** has a cooling jacket through which cooling liquid constantly flows from a cooling device **113** corresponding to that of **23**. Reference **114** indicates a glass ball dispenser connected to the stirrer-crusher **111** and corresponding to the dispenser **24** of FIG. 1. In FIG. 5, there is no alarm device like that **63** and likewise it will be observed that a viscosity meter and dynamometer corresponding to items **25** and **27** of the earlier embodiment, are also absent. A viscosity meter **115** corresponding to that **26** and connected to the discharge of the stirrer-crusher **111**, however, is connected, unlike the case of FIG. 1, in a controlling function to the glass ball dispenser **24** and controls the dispensing rate in accordance with the viscosity of the ground mash. If the measured viscosity is too low, then this is an indication that the grinding action is not sufficiently intensive and this is due to a deficiency in glass balls. If a low viscosity is measured, then the rate of dispensing of glass balls is increased, and vice versa. For the rest, the diagram of FIG. 5 corresponds to that of FIG. 1, in particular as far as the parts which have not been illustrated are concerned.

In accordance with a further modification of the diagram of FIG. 1, in that of FIG. 5 it is possible instead of the viscosity meter **115**, or in addition thereto, to provide a granulometer which supplies an indication of when the ground mash contains too many tobacco grains whose size exceeds a certain limit. This, too, is an indication of a deficient grinding effect due to a deficiency in numbers of glass balls. Thus, if the granulometer detects such an excess of oversize grains, then accordingly it controls the glass ball dispenser to make it operate at a higher dispensing rate and vice versa.

FIG. 6 illustrates the glass ball dispenser **24** of FIGS. 1 and 3, in detail. In FIG. 6, an elongated upright tube **6**, with its bottom end connected to the line **60**, does duty as a pressure lock. The tube **61** flared at its bottom end, forms a conical valve seat **120** for a valve cone **121** which is attached to a rod **122** projecting upwards out of the tube **61**. The tube **61** is flared at its top end to form a filling funnel **123** and is kept topped up with glass balls to at least such a height that the column **124** of balls can overcome the pressure of the mash flowing through the line **60** and can move downwards when the check valve arrangement constituted by the valve cone **121** and the valve seat **120** is opened in the manner shown. The rod **122** is longitudinally movable in a sliding bearing **125** which in turn is connected by spokes **126** to the rim of the funnel **123**. At the top, free end of the rod an armature **127** is attached and between this armature and the spokes **126** a compression spring **128** is arranged which tends to force the armature **127** upwards and to close the valve. The reference **129** indicates an electromagnet which is attached to the spoke arrangement **126** and, in the manner indicated, energizes the armature **127** against the action of a spring **128** bringing it downwards and therefore opening the valves **120, 121**, so that the glass balls can slip down into the line **60**. Reference **130** indicates a generator which produces the energizing pulses for the electromagnet **129** so that the latter is periodically and frequently energized, for example every 5 minutes for a time of 2 seconds. During such energizing period, the number of glass balls then drop into the line **60**. The pulse repetition frequency of the generator **130** is adjustable while maintaining the pulse duration constant. If the repetition frequency increases, then the rate of dispensing of the glass balls is increased, and vice versa. In accordance with FIG. 1, the repetition frequency is adjusted in accordance with the data from the dynamometer **27**, while in the case of FIG. 5 the adjustment is in accordance with the data from the viscosity meter **115** or, instead of this or in addition thereto, in accordance with the granulometry data.

For the viscosity meter **26**, in FIG. 7 it can be seen that an S-shaped double bend is provided in the discharge connection **58**. At this point, a rotor **130** projects into the mash flow and this is driven by a constant speed electric motor **131**. The power consumption of the electric motor **131** depends, other things being equal, upon the viscosity of the mash flow and is continuously measured by the dynamometer (watt meter) **132**. The measured viscosity data pass to the alarm system **63**.

The granulometer referred to in the consistory of FIG. 5, is connected to the discharge connection **133** of the stirrer-crusher mill in the case of FIG. 8, and is generally marked **134**. It consists of a measurement tube **135** arranged in a vertical attitude and having its top end connected through a shut-off valve **136** to a suction device which has not been shown, the tube having an enlarged portion **137** at its bottom end opening into a discharge connection **133**. At the bottom, this measuring tube exhibits a restricted portion **138** into which a line **139** opens leading from a water reservoir **140**. Close beneath the shut-off valve **136** there is an open mercury manometer **141** the mercury column **142**, in which is subjected to vacuum with the shut-off valve **136** open as drawn, so that two electrical contacts **143** are exposed. The electrical contacts **143** are connected to an analzyer equipment **144**. The reference **145** indicated two capacitor plates which are so arranged that the flow in the measuring tube **135** has to pass between them, and which are connected to the analyzer equipment **144**. Reference **146** indicates a pulse generator and **147** is a switch system which, under the control of the pulses from the pulse generator **146**, periodically and briefly closes the shut-off valve **136**. With the latter valve open, some mash is drawn in from the line **133** and water from the line **139**. The highly diluted mash mixing at the restricted location **138**, passes the measuring tube and is processed elsewhere. The mercury column **142**, as indicated, is drawn up. On reception of a timing pulse from pulse generator **146**, the shut-off valve **136** is briefly closed and the mercury column **142** falls back again and in so doing draws in a small quantity of mash with water, and initially operates the first of the contacts **143** and then the second. With operation of the first contact **143**, the analyzer equipment **144** is switched in and with operation of the second, it is switched out. While the analyzer equipment **144** is switched in, a quite specific quantity of highly diluted mash flows through the interspace between the capacitor plates **145**. Each tobacco particle entrained in this flow gives rise to a change in capacitance and this will be the greater the larger the particular particle is. If the number of electrical pulses stemming from largish particles, exceeds a specific predetermined number during a measurement interval, then the analyzer equipment **144** detects this and produces on its control line **148** a control pulse which increases the dispensing rate of the glass balls. If the number of electrical pulses stemming from largish particles undershoots a certain predetermined number, then on the control line **148** a control pulse appears which reduces the rate of dispensing of glass balls.

EXAMPLE 1

500 l. of water in which 100 g. of potassium carbonate have been dissolved, accompany a charge into the stirrer mechanism **6**. Into this solution, 100 kg. of ground Virginia tobacco are introduced from the dispenser **5**. Using this, a suspension is produced in the stirrer mechanism **6**, and this is dumped at a uniform rate by the dosing pump **19** to the stirrer-crusher **2** and there ground (milled). The still warm mash coming from the stirrer-crusher **22** has mixed with it per 100 g. of tobacco, 4 kg. of glycerine, 1 kg. of sodium carboxy methylcellulose and 1 kg. of asbestos fibres, and the mash is then supplied to the spreader **31** and formed into a sheet while drying. Immediately on the heels of this charge from the stirrer-mechanism **6**, a charge of precisely the same composition from the stirrer mechanism **7** then follows, and so on. The branch containing the flotation devices **8** and **9** remains closed.

EXAMPLE 2

600 l. of water with 50 ml. of a 25% ammonia solution are supplied to the stirrer mechanism **6**. Into this aqueous solution, 100 kg. of fine-ground Java cigar

tobacco are introduced from the dispenser **5**. Also added are 5 kg. of glycerine, 1 kg. of citric acid and 1.5 kg. of sodiumcarboxymethyl cellulose. The mixture is stirred in the stirrer mechanism **6** and the resultant suspension is fed at a uniform rate by the dosing pump **19** into the stirrer-crusher **22** where it is ground and homogenized and where the resultant friction heats it to an appropriate reaction temperature. To the wet-ground tobacco mash coming from the stirrer-crushed **22**, 2 kg. of asbestos fibres per 100 kg. of tobacco, are added. Then, the tobacco mash is supplied to the spreader **31** and formed into a sheet while drying. Immediately following this charge from the stirrer mechanism **6**, an identically composed charge comes from the stirrer mechanism **7**, and so on. The branch containing the flotation devices **8** and **9** remains closed.

We claim:

1. A continuous process for producing regenerated tobacco from a tobacco mash which comprises continuously feeding finely divided basic tobacco and a liquid into a body of ground granular material, said material being continuously stirred, the ground tobacco and granular material being filtered out of the body in the form of a homogeneous tobacco mash, which mash is solidified into regenerated tobacco material by the subsequent removal of water therefrom, the process being further characterized in that the grinding grains are ground down to a size corresponding the filter pass opening size and that this detritus constitutes about 0.3 to 1% by weight related to the weight of the regenerated tobacco; said process further being characterized by the step of compensating for the material loss in the body by replenishing the grinding grains lost in the processing with grains that are much larger than the ones passing through the filter, said grinding grains behaving in a neutral fashion during the processing and, ultimately, during smoking of the regenerated tobacco product.

2. A process as claimed in claim **1**, characterized in that the material to be ground is forced in a substantially horizontal direction through the body, the latter having

a height which is substantially smaller than the distance of the horizontal transit within the body.

3. A process as claimed in claim **2**, characterized in that the body flows through a cross-section which reduces in the direction of flow.

4. A process as claimed in claim **1**, characterized in that part of the heat produced by the homogenizing of the body, is separately dissipated.

5. A process as claimed in claim **1**, characterized in that the material to be ground is supplied uniformly into the body; that the energy absorbed in circulating the body is continuously measured; and in that the replacement with grinding grains is continuously adjusted to accord with the results of such measurement.

6. A process as claimed in claim **1**, characterized in that the supply of the material to be ground into the body takes place in a uniform manner; in that the viscosity and/or grain size of the tobacco mash taken from the body is continuously measured; and in that the replenishing of the grinding grains is continuously adjusted to accord with the measured results thus obtained.

7. A process as claimed in claim **1**, characterized in that in order to effect uniform supply of material for grinding, a mixture or slurry is formed from the reduced basic tobacco material and the liquid, and this is then pumped into the body at a dosed, uniform flow rate.

8. A process as claimed in claim **1**, characterized in that the homogenized tobacco mash filtered out of the body, is subjected to secondary homogenizing.

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