

Technical field

The invention relates to a process for the production of products ground from grain, such as flour, semolina, fine semolina or middlings etc., wherein the material is subjected a number of times to roller grinding and screening, using the high-grinding principle.

State of the art

Nowadays in the commercial and industrial processing of grain it is possible to detect a strong tendency which at least in part appears to be a retrograde one. This is the demand for high-value basic foods, which in the field of cereal is regarded almost symbolically as synonymous with flour ground on stone mills and wholemeal bread baked therefrom. The accusation is made more or less that milling in its capacity as an interface between the farmer on the one hand and the baker and consumer on the other hand developed in a wrong direction, since the end products either no longer contain or will only contain in damaged form some important constituents. But this attitude - resulting from too much division of labour and being in accordance with the resulting modern scientific "over-specialisation" in ways of thinking - overlooks some basic facts:

- the supplying of good foods within the context of current eating habits, including leaving it to the consumer to decide for example from which foods he or she is going to obtain roughage,
- the preparation of foods with as little loss as possible being incurred during processing,
- the economic aspects of food processing, including especially the energy aspect,
- good preparation from the nutritional and physiological points of view, so that human beings and animals can

get as full value from the food as possible, in other words with minimum losses,

- thorough cleaning of the food and hygienically satisfactory processing, for example including dealing with substances harmful to health, such as bacteria, fungus etc.,

- offering a large range of different foods based on the same raw produce.

Wholemeal or wholegrain/dark flour was obtained, by the old stone-grinding principle, by grinding the whole grains one or more times and possibly screening-out a proportion of the husks or the outermost layers of the cereal grain. This system which was still in widespread use up to a few decades ago, and which was also known as low grinding, undoubtedly has the advantage that almost all the constituent substances of the cereal grain remain integrally in the flour and breaks and, in the form of bread and other cereal products, provide high-quality food for people. But this oldest method also has disadvantages. The products obtained from wholegrain grinding have only limited keeping qualities especially if not properly stored, for two reasons. The corresponding "health food" products are mostly intended for early consumption or use. On the other hand, dirt, bacteria, mould spores etc. usually adhere only to the outside of the individual grain. But it is precisely these which impair product quality and reduce shelf life, or would spoil the mill products after a short storage time under poor conditions.

Also, it is often overlooked that the individual cereal grain comprises greatly differing portions. Taken in isolation the various parts of the cereal grain give the ground products flour, semolina, fine semolina or middlings, feed-grade flour, bran, respectively specific properties, for example specific baking properties. Such products,

required for specific purposes (pasta semolina, white flour, etc.), can only be separated out partially when using a wholegrain or low grinding method. It has only been high grinding which has made it possible to produce the large number of ground products required by the now widely established eating habits, if the basic facts or the conditions listed earlier hereinbefore are to be observed.

The end products can be given a rather special flavour (wholemeal bread, brown bread, cake or biscuit products, etc.) depending on which parts of the interior of the cereal grain are obtained, or combined, for the flour. But more particularly high grinding allows any fraction which is produced separately to be re-combined in a flour, for example a wholemeal flour, or a flour with an increased protein content, or mixed into a flour with a higher proportion of cereal grain germ. Thus the high grinding system allows substantially better targetted grain preparation. To take an analogy, in the meat industry, there is no production of "wholefood mince" from animal carcasses.

In a so-called industrial firm, therefore, high grinding offers many advantages which have been only too little used up to the present time. An average-size mill with relatively few people operating it has a daily production of for example 100 - 200 t finished product. The old stone mill with one man has a daily production of 100 - 200 kg.

High grinding as known at the present time is characterised by repeated grinding and sifting after each grinding passage. This is true both in soft wheat and

hard wheat mills and also in maize mills. Up to two or three decades ago this operation was often repeated 15 to 20 times. But it was shown in more recent developments that twelve to fifteen grindings on average, given good management of operations, leads to the same results. Since the beginning of the Seventies the short high grinding method, as against the long high grinding method which preceded it, has become established as the state of the art almost world-wide.

A good miller is able himself to achieve the quality standard required by the further-processing industry, bakers, pasta manufacturers, etc., from greatly varying raw materials by mixing the various cereal qualities and closely controlled mill working, more particularly through very careful stepwise dissociation of the various parts of each cereal grain.

To stay competitive, a mill must, from a specific quantity of raw material, produce a specific quantity of end products of high quality and thus also at a relatively good price. In other words, a grain mill is always aiming at achieving a high yield in white flour, semolina etc. The mill is operating well only if the quality criteria are met. An important factor as regards good economy in operation is the amount of operating equipment needed, which in a mill e.g. depends directly on the number of grinding and screening passages. All endeavours in very recent times show that, when using high grinding, the grinding work cannot be further shortened without directly reducing either the yield or the product quality, so that at the present time there seems to be some stagnation in the development of the grinding process in mills.

Description of the invention

The invention has as its object to develop a new high grinding process, whilst fully retaining both the flexibility or adaptability of the mill to the particular specific grinding task in view, and also end product quality as well as the controllability of the grinding process, but with an improvement in the economic aspects of the mill.

The object has been achieved in that a process has been developed for the production of products ground from grain, such as e.g. flour, semolina, fine semolina or middlings, etc, in accordance with the high-grinding principle, wherein the material to be ground is roller-ground a number of times, preferably twelve to twenty times, and repeatedly screened, wherein according to the invention the material to be ground is conducted at least twice through double roller grinding stages without screening between the individual stages of the double grindings, and sifted after each double grinding.

A first series of experiments with the new process proposed by the invention found, to the surprise of all the experts participating, that it was possible to achieve the set object completely. But it was interesting to observe that a triple grinding without intermediate sifting, a manner of operating used to some extent in the beginnings of modern milling, gave significantly poorer results. Partly this can be put down to heating the material too much, given the mill performance levels required at the present day, but very probably also to the fact that if triple grinding is used without intermediate sifting a considerably larger proportion of the material being ground is disadvantageously comminuted, or too much in the way of fines is produced at too early a stage. Here is

probably one of the most important secrets of grinding in mill work, namely carrying out each working step such that it is separately controllable and supervisable. The head miller, with his experience, knows what he is doing at every stage. Therefore, in actual practice, particular conditions are provided at each milling stage, for example by adjusting the grinding gap, special fluting and differentials at the grinding rollers, throughput through a grinding passage, the mill diagram, etc.

It has been found very important that each of the grinding passages remains controllable and also adjustable i.e. the two grindings of the double-grinding passage independently. But, as a result, with the new solution provided, the interventions required in actual practice remain available at least as far as grinding is concerned. Milling remains what it has always been for any good miller, a hand craft, in which he, with all his human senses, is the responsible controller of the way the grinding goes.

It has been found particularly advantageous to grind the material by double and single grinding in combination, the material being sifted after each double grinding passage and each single grinding passage.

It is especially preferable to conduct at least the first and second breaks (B_1 and B_2) and also the first and second reductions (C_1 and C_2) through in each case a double grinding without intermediate sifting.

In this case it is possible to pass the material four to six times through double grinding stages without screening between the double grindings, and to sift after each double grinding.

This allows the carrying out, and especially for reductions, of double grinding passages and a combination of two to

six single grindings with an intermediate sifting in each case.

In this way, however, it was possible to show that with the new high grinding process the advantages of the invention are utilisable for each specific case "more or less", and for example it becomes possible to have a cost reduction of from 10 to 30 % relatively to the state of the art for operating the plant.

The new invention also relates to a grain mill for producing products ground from grain, such as flour, semolina, fine semolina or middlings etc., with the high-grinding system, with especially twelve to twenty grinding passages with pairs of rollers and with a plurality of screening passages, each provided after a grinding passage, with plansifters or sifter compartments.

This new grain mill is characterised in that it comprises at least two double grinding passages with in each case two grinding roller pairs situated one after the other without sifting between the two roller pairs.

The new grain mill is notably different from hitherto known mills especially from the constructional point of view, since a substantial concentration of work is now possible.

It is especially preferable to construct the new grain mill with two in each case double grinding passages as one roller mill unit, as an 8-roller mill with in each case two grinding roller pairs situated one above the other.

With the form of an 8-roller mill, there is now a new control possibility for the miller, in that two grinding stages can be supervised at the same time and at the same place. This means that an alteration in for example the first grinding roller pair and also in the second roller pair, but also the influence of the alteration of the first

roller pair on the grinding result of the possibly unaltered second roller pair can be judged immediately. As far as is known to the applicant company this has never been possible hitherto in the field of high grinding. Since there is sifting between each grinding, in the state of the art it has not only been necessary to wait for the appropriate length of time until the material has passed through sifting and the second grinding stage, but each intermediate sifting also changed the composition of the ground material, since individual fractions were conducted to other passages. It has been found that the slight disadvantage that a small fraction is unnecessarily comminuted in the second grinding is more than compensated for by the advantage of direct controllability and direct intervention at both grinding roller pairs.

At present the best solution is considered to lie in the use in combination of double grinding passages and single grinding passages with a screening passage in each case after the double grinding passage or the single grinding passage respectively.

It is especially preferable to use both eight-roller mills and four-roller mills in combination.

It is also proposed that at least two eight-roller mills are provided, and each of the grinding roller pairs is to have its own grinding gap adjustment arrangement.

In the eight-roller mills each of the upper roller pairs is to have associated with it an adjustable feed regulator, and a funnel-shaped product guide is to be arranged for direct transfer from the respective upper roller pair to the lower roller pair, and grinding gap adjustment devices are to be associated with each roller pair, also in each case an inspection door for sample

taking after each grinding passage.

Preferably, also, both the feed chamber of the upper roller pair and the feed chamber of the lower roller pair are connected by means of ducts to an aspirator.

To suit the needs of grinding mills, it is also proposed that each roller pair is fully provided with an individual adjustment device and also a preventive device against foreign matter, and the rollers of each roller pair have respectively differing rotational speeds (a speed differential), and preferably the pairs of rollers situated above each other in each case have a jointly controlled disengaging device.

Control and servicing are facilitated if the rollers of a roller pair are arranged in a horizontal plane.

In a further development of the underlying idea of the invention, a further great advantage can be achieved for the plant in general if the grain mill is designed as a compact mill, and has a compact cleaning arrangement, at least two eight-roller mills and a large plansifter.

Concentration of working operations has often been seen as having something disadvantageous about it. But in the case of the new grain mill it has been found that sensible concentration increases easy supervision and allows millers to react more quickly. The control of the mill is thus facilitated, although in by far the most cases of actual use the same quality standards are achievable as in the state of the art. It has been possible to reduce considerably the degree of complexity of the mill diagram. The new inventive ideas in fact result in a better starting position for a sensible further increase in the degree of automation, in that the grinding gap adjustment devices are associated each with a remote control arrangement, and computer means for the storage and retrieval of the grinding gap adjustments specific to each grinding

task, as well as all other adjustment values of the processing and transporting means.

If the raw material is known, likewise the other parameters such as ambient temperature, air moisture, the state of all units (fluting of the rollers, screen fabric of the plansifters, etc.) the mill, once well adjusted, can be operated fully automatically over relatively long periods of time even without the immediate presence of skilled personnel. Thus the new invention makes possible a considerable contribution to the perfecting of high grinding, but bringing-in not further complication but rather a simplification with almost no cutting-down of the miller's contribution.

The invention will now be described in further detail.
Brief description of the invention

In the drawings

Fig. 1 shows an eight-roller mill,

Fig. 2 a view of the drive and adjustment means of Fig. 1,

Fig. 3 shows a new grain mill,

Fig. 4 shows a grinding and sifting diagram according to the state of the art,

Fig. 5 shows an example of a new grinding and sifting diagram,

Fig. 6 shows grinding and sifting in a diagrammatic view, with a further example of embodiment.

Ways of carrying out the invention

Fig. 1 will now be referred to. The eight-roller mill 1 comprises two halves, the left half being shown as a breaks passage 2 and a right-hand half shown as a reductions passage 3. The breaks passage 2 usually has fluted rollers

4 and 5 respectively, the faster-running roller 5 being indicated by means of two arrows in the illustration. Below each of the rollers 4 and 5 is a stripping brush 6. In the reductions passages, mostly smooth rollers 7 and 8 respectively are used, and stripping knives 9 for keeping the roller surfaces clean. Depending on the specific grinding work, the respectively lower roller pair 4',5' and 7',8' respectively will be of the same type, coarse fluted, fine fluted, or smooth, as the corresponding upper pair.

The material is conducted through a feed cylinder 10 at the left or right into the roller mill 1. Only in the case of very large mill outputs is it expedient to construct the left and right roller mill halves identically, such that the two halves each have to process half of the quantity of material. In the feed cylinder 10 a sensor 11 is constructed as a so-called "Christmas tree" shaped sensor as illustrated, this controlling a product feed arrangement 12 so that a quantity of material arriving above at any time in the feed cylinder 13 is discharged in the same quantity through the product feed arrangement. The material is conducted through a feed duct 13 directly into the grinding gap. A strong air flow is produced in the feed duct 13, which advantageously can be ensured by two air ducts 14 which extend about the rollers 4, 5 and 7, 8 respectively. The material broken by the upper roller pair 4, 5 is conducted via a product discharge hopper 20 directly into the grinding gap of the lower roller pair 4', 5'. At the lower roller pair 4', 5' also the air is aspirated through air ducts 14. The material for grinding is transferred through a product

discharge hopper 20 and a transfer element 22 to intermediate carry-over arrangements. All four roller pairs 4, 5 - 4', 5' - 7, 8 - 7', 8' can be adjusted as regards the grinding gap by an adjustment device 15. All other devices such as preventive devices against foreign matter, engaging and disengaging devices, etc., are used as in normal four-roller roller mills. In this connection, DE-PS No. 27 30 166, the whole of its content, should be referred to. It has been found that the unit for the roller pair which was shown in the said publication belonging to the applicant company can also be used in the eight-roller roller mills, so that in the event of a combination of eight-roller and four-roller mills it is always possible to start from the same basic construction for the so-called roller set, and this is a further advantage for the manufacturer as for the user.

In individual cases it may be appropriate to provide a feed roller or product distribution roller above the lower roller pair. But preferably roller engagement and disengagement are effected for both roller pairs by means of the common sensor 11.

An air guide 18 is additionally shown in the product discharge hopper in the right-hand half of the Figure. This may afford advantages especially with middlings-type and flour-type materials, since separate conducting of air and product allows more compact guiding of the falling flow of product.

Each grinding roller pair (4, 5 - 7, 8) has its own grinding gap adjustment device comprising a hand wheel 15 and the corresponding adjustment elements. A motor-operated adjustment device 16 can be provided additionally,

and both can monitor the instantaneous spacing of the two grinding rollers by means of an indicator device 17. Motor adjustment can also be effected automatically by computer (R) and memory means 58.

There is also associated with each grinding roller pair an inspection door 19 which is shown in the closed position above and in the open position below in the right-hand half of the illustration. The inspection door can be opened whether or not the roller mill is in operation. Because of additional air ducts 14, 18 described hereinbefore, constant air pressure conditions and therefore constant grinding conditions are maintained.

Reference will now be made to Fig. 2, in which adjustment elements are shown as a sub-assembly 100, and also a controllable adjustment drive 100'. The two grinding rollers 104 and 105 are mounted on a common support 101. The free roller 105 is pivotably secured on a stationary eccentric pin 102, engagement and disengagement being controlled by an appropriate lever 103, also a disengagement cylinder 106. Through the pivoting movement of the lever 103 the eccentric pin 102 is rotated and causes horizontal displacement of the lower portion of a pivotable bearing housing 107, so that as a result the spacing of the two grinding rollers can be pre-adjusted. This arrangement would not be very suitable for the precise adjustment of the grinding rollers. In fact it is used only for bringing the grinding rollers into an engaged or disengaged position, in other words into two fixed positions. The actual fine adjustment of the grinding rollers 104 and 105 is effected through an adjustment spindle 108, which by rotation directly moves an adjustment arm 109

about a stationary bearing pivot 110. The upper, shorter end of the adjustment arm 109 is connected in force-locking manner to the pivotable bearing housing 107 by means of the connecting rod 111. Transmission of force is effected via knife-edges, these at one side forming part of an overload spring safety arrangement 112. At the opposite side there is arranged on the connecting rod 111 an adjustable counter-holding head 113, also a pressure measuring device 114 with a pressure indicator device 115. In order to be able to adjust the grinding rollers in parallel manner when servicing has to be done, a correction can be made at the particular side required by means of adjustment screws 143, 144. The adjustment spindle 108 is held stationary by bearing 111', and can be operated by means of a handwheel 116 which has a directly built-in indicator dial, or alternatively by motor means, a transmission chain 118 and a geared motor or drive motor 119. The drive motor 119 is secured to the roller frame 126 and is in direct connection with the adjustment spindle 108 by means of a slip clutch and a chain wheel 123.

Also connected directly to the adjustment spindle 108 is a position pickup 120, so that every movement of the chain wheel 123 or of the hand wheel 116 is recorded in the position pickup and passed to the desired places. A drive belt 128 for driving the grinding rollers 104 and 105, 104' and 105' respectively is also shown, only sketchily, in Fig. 2. It is also possible to provide an electrical power requirement measuring and indicating device 129 in the drive system. In this way for example the electrical consumption can be limited at lower and upper values, and for example the grinding rollers can be disengaged from each other if the preselected range is exceeded.

All the signals of a roller mill are preferably co-ordinated and controlled by means of an in-machine computer R, this computer being able to call the required desired values from a central computer with memory Sp. The position indicator is preferably provided with a position limit value switch which is adjustable to preselectable limit values, and in this way can prevent an automatic misadjustment. A position limit value switch has the advantage that a manual misadjustment can also be obviated therewith, since both hand wheel and automatic adjustment result in a corresponding displacement travel of the chain 118. The position pickup just like the adjustment motor 119 can be connected to an input/output unit which receives and emits appropriate signals from the machine computer, correspondingly with digital display and manual input keys. In the same sense the pressure measuring and indicator device 114, 115 can be connected to the machine computer. One or more safety arrangements can be provided at the same roller mill depending on the extent to which the roller mill is developed. For example if fluted rollers are fitted, grinding pressure supervision makes less sense, whereas there is advantage in supervising the spacing of the grinding rollers, whether through the position indicator or a spacing measuring device. The situation is reversed in the case of smooth rollers, when pressure monitoring is advantageous. With a machine computer and the indicated signal lines it is intended to show that the central computer and memory control a large number of, possibly all, the roller mills in a mill, and also co-ordinate all control functions if required.

It has also been found especially advantageous if the digital display indicates a value corresponding to a time measurement (05.50 clock) and preferably reproduces an

identical value corresponding to a position indicator device or the indicator dial of the hand wheel.

The great advantage is that the empirical values of non-automated or non-remote-controllable roller mills can be compared and utilised for the constructing or improving of suitable control programmes.

Fig. 3, then, shows a complete grain mill, in a greatly simplified form. Taken very generally, the starch mill comprises a storage silo 30 for the stored grain, mixing and standing boxes 31, a processing tract proper 32, and finished-product compartments 33. Downstream of the finished-product compartments 33 the finished products are delivered direct via a weighing system 34.

In more detail, operations proceed as follows. From storage compartments 35, 35₁, 35₂, 35₃, etc. the desired raw grain mixture is produced and conveyed via weighing apparatus 36, a horizontal conveyor 37, an elevator 38, a further horizontal conveyor 39, into a mixing compartment 40. From the mixing compartment 40 the still unpurified grain is removed and conveyed via a weighing apparatus 41 a horizontal conveyor 42 and an elevator 43 into the grain cleaning stage 44. In a compact cleaning arrangement 45 large foreign substances (lumps of earth) are screened out, stones sorted out, husk fragments removed by suction. Reference should be made to Applicant's EP-A-318053, the full content thereof). Then the material is put into a trieur 46 in which long and round foreign seeds are removed, and through a tumbling machine 47 the grains are freed of adhering dirt, the requisite water quantity is added in an intensive wetting device 48, and the result stored in a conditioning compartment 49 for the required time. The grain, wetted and conditioned for about 12 to

48 hours is removed from one of the conditioning cells 49 or 50, transferred by means of an elevator 43' and after the adding of 0.1 to 0.3 % water (wetting arrangement 51 before B_1 , and a homogenising compartment 52, direct to the first grinding passage (B_1 or first double grinding passage 53.

For grinding, the material is conducted through double grinding passages 53, 53', 54, 54', etc., the material after each double grinding being passed by a pneumatic conveying system 55 into the screening compartments of a large plansifter 56. The so-called rear grindings are constructed as hitherto as single grinding passages 57. From these the material after passing through a roller pair of an appropriate four-roller roller mill is passed into a plansifter 58 of the usual size in the state of the art. The finished products produced from the grinding or from the large plansifter 56 and the plansifter 58 or the other screening and sifting units used in the overall mill such as semolina cleaning machines, etc., are stored in compartments 59, 60, 61, 62, 53, and delivered away as and when required via a weighing apparatus 34. They can be prepared for despatch by way of a bagging station 64 or a tank waggon loading unit 65. The entire plant is controlled from a central control system with all the necessary computing means by the head miller.

A further interesting advantage is that after the double grinding passages large sifters can also be used which have specifically larger screening surfaces, for example 30 to 60 % larger than in the case of the screening surfaces of the four-roller roller mills, so that here again a concentration of working operations is possible.

According to present estimates a total of 10 to 40 % can be saved in space and provision of machines with the new invention as regards plansifters and roller mills; and this can be done without involving the disadvantages of new unknown grinding principles, whilst maintaining mill through-put and end product quality. Energy consumption can also be reduced considerably.

Fig. 4 shows the diagram of a normal grain mill according to the state of the art. The simple break passages (B_1 , B_2 , B_3 , B_4) are shown with pairs of rollers with hatching, in symbolic manner. This means that these rollers are constructed as fluted rollers.

After each single grinding (B_1 or B_2 etc.) the broken grain obtained is transferred each time to a sifting passage for subdivision into various granulations. Part of the B_3 and B_4 overtails is conducted through the bran brushes or finishers $DBr.1$, $DBr.2$ for cleaning the husks. The throughs of bran finishers $Br.1$ and $Br.2$ are taken over with $DBr.1$ and $DBr.2$ and divided into flour and bran. The throughs of $DBr.3$ are cleaned in the special plansifter compartment $DBr.1$. Correspondingly the entire filter flour from the pneumatic conveying means is sifted-out on the plansifter compartment DF . Individual overtails from B_1 and B_2 are cleaned directly in the semolina cleaning machines P_1 and P_2 respectively.

The reduction passages C_1 to C_{11} take over the overtails and throughs from $Div.1$, P_1 and P_2 . Correspondingly to the break passages, in the case of the reduction passages also after each grinding the material being ground is conducted into the corresponding downstream sifter compartments. The product flow is arranged, in accordance with rising numbers 1, 2, 3, etc., from the first grinding passage to the first sifting passage, second grinding passage

to the second sifting passage, etc. All throughs in all the sifting passages can be removed as finished flour.

In the reduction passages there is used in each case between the actual roller grinding and the sifter a detach-er (for resolving the flakes), designated with a circle, or a special detach-er for intensive resolution (circle and cone).

The diagram in Fig. 5 shows per se in the matter of object and mill throughput performance the same mill size as in Fig. 4, Fig. 5 being the new solution and Fig. 4 the state of the art for comparison therewith.

The two in each case roller pairs arranged below one another constitute a double grinding stage in Fig. 5. B_1 and B_2 , the first two break passages, are combined to constitute the first double grinding stage 53. B_3 and B_4 constitute the second double grinding stage 53'. The first and second double grinding passages are combined in a first eight-roller roller mill 67 according to Fig. 3. Analogously the reduction passages C_1 , C_2 , C_4 and C_5 provide the eight-roller roller mill 68, and the reduction passages C_7 , C_8 , C_9 , C_{10} the eight-roller roller mill 69. Only the reduction passages C_3 and C_6 are constructed as single grinding passages, just as in Fig. 4 i.e. the state of the art, and here form together a four-roller roller mill 57 according to Fig. 3.

Of course the diagram shown in Fig. 5 is only a preferred example of embodiment, on which, as mentioned initially, very many variations are possible within the scope of the new invention. But a mere look at Fig. 4 and Fig. 5 shows very strikingly the great simplification which is possible with the new solution idea.

Reference will now be made to Fig. 6. This Fig. 6 shows the combination of double grinding passages and single grinding passages. The double grinding passages B_1/B_2 and

C_1/C_2 are combined in a single eight-roller roller mill 70. A conveying conduit 140 brings the material from the first double grinding B_1/B_2 to the first large sifting compartment 73. The third break material B_3 , also the fourth B_4 are ground on a single grinding passage in a 4-roller roller mill 142. Upward transfer devices 143 and 144 respectively bring the third and fourth break materials into the corresponding screening compartments 145 and 146 respectively. The first two reduction passages C_1 and C_2 are again constructed as double grinding means. The material produced by C_2 is conducted via a pneumatic conveying conduit 142 into the second large screening compartment 74. The reduction passages C_3 and C_4 are again formed as single grinding passages (four-roller roller mill 151) and the corresponding products are conveyed with upward transfer devices 147 and 148 respectively into the corresponding third and fourth screening compartments 149 and 150. The following reduction passages, likewise the rear break passages, which are not shown, can be constructed as double grinding passages or as single grinding passages depending on the special requirements of the grain mill. The large surface screens 73, 74 etc. can be combined to form a special large plansifter 152, likewise the screening compartment 145, 146, 149, 150 can be combined in a plansifter according to the state of the art, correspondingly.



C l a i m s

1. Process for the production of products ground from grain, such as e.g. flour, semolina, fine semolina or middlings, etc., in accordance with the high-grinding principle, wherein the material to be ground is roller-ground a number of times, preferably twelve to twenty times, and repeatedly screened, characterised in that the material to be ground is conducted at least twice through double roller grinding stages without screening between the individual stages of the double grindings, and sifted after each double grinding.
2. Process according to claim 1, characterised in that the material is ground by double and single grinding in combination, and the material is sifted after each double grinding passage and each single grinding passage.
3. Process according to one of claim 1 or 2, characterised in that at least the first and second breaks (B_1 and B_2) and also the first and second reductions (C_1 and C_2) are conducted through in each case a double grinding without intermediate sifting.
4. Process according to claim 1 or one of claims 2 or 3, characterised in that the material is conducted four to six times through double grinding stages without screening between the double grindings, and sifted after each double grinding.
5. Process according to one of claims 1 to 4, characterised in that, especially for the reduction, two to six single grindings are effected with an intermediate sifting in each case.



6. Grain mill for the production of ground grain products such as flour, semolina, fine semolina or middlings, etc., using the high-grinding principle, with especially twelve to twenty grinding passages with pairs of rollers and with a plurality of screening passages, each provided after a grinding passage, characterised in that it comprises at least two double grinding passages with in each case two grinding roller pairs situated after one another without sifting between the two roller pairs.

7. Grain mill according to claim 6, characterised in that two in each case double grinding passages are arranged as one roller mill unit, as an 8-roller mill, with in each case two grinding roller pairs situated one above the other.

8. Grain mill according to claim 6 or 7, characterised in that it uses, in combination, double grinding passages and single grinding passages with a screening passage in each case after the double grinding passage or single grinding passage.

9. Grain mill according to claims 6 to 8, characterised in that it comprises in combination both 8-roller mills and 4-roller mills.

10. Grain mill according to claims 6 to 9, characterised in that it comprises at least two eight-roller mills.

11. Grain mill according to one of claims 6 to 10, characterised in that each of the grinding roller pairs has its own grinding gap adjustment arrangement.

12. Grain mill according to claims 6 to 11, characterised in that in the eight-roller mills each of the upper pairs



of rollers has associated with it an adjustable feed regulator, and a funnel-shaped product guide is arranged for direct transfer from the respective upper roller pair to the lower roller pair.

13. Grain mill according to claims 6 to 12, characterised in that grinding gap adjustment devices are associated with each roller pair, also in each case an inspection door for sample taking after each grinding passage.

14. Grain mill according to claims 6 to 13, characterised in that both the feed compartment of the upper roller pair and the feed compartment of the lower roller pair are connected by means of ducts to an aspirator.

15. Grain mill according to claims 6 to 14, characterised in that each roller pair is fully provided with an individual adjustment device and also a preventive device against foreign matter, and the rollers of each roller pair rotate at respectively differing speeds, and preferably the pairs of rollers situated above each other in each case have a jointly controlled disengaging device.

16. Grain mill according to claims 6 to 15, characterised in that the rollers of a roller pair are each arranged at the same height.

17. Grain mill according to claims 6 to 16, characterised in that it has a compact cleaning arrangement, at least two eight-roller mills and a large plansifter.

18. Grain mill according to one of claims 1 to 17, characterised in that it has double grinding passages and



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single grinding passages, the double grinding passages having associated with them on average in each case 20 to 50 % larger screening surface areas in relation to the screening surface areas of the single grinding passages.

19. Grain mill according to claims 6 to 18, characterised in that the grinding gap adjustment devices are associated each with a remote control arrangement and computer means for the storing and retrieval of the grinding gap adjustments specific to each grinding task, also of all other adjustment values of the processing and transporting means.