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(71) Applicant: **NABISCO BRANDS, INC.**
100 DeForest Avenue
East Hanover New Jersey 07936(US)

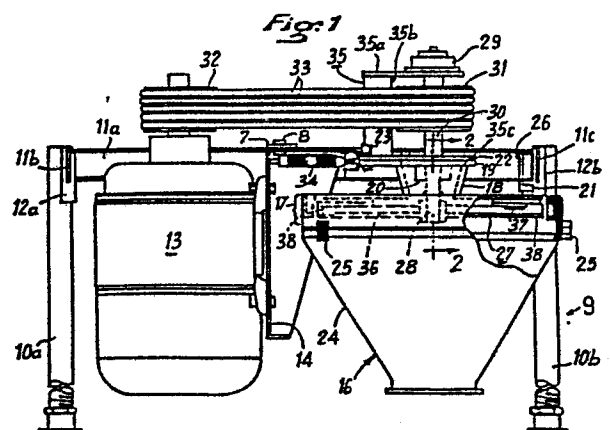
(72) Inventor: **Karwowski, Jan**
705 Ewing Avenue
Franklin Lakes New Jersey 07417(US)

(72) Inventor: **Magliacano, Anna Maria**
35 Dodd Street
East Orange New Jersey 07017(US)

(74) Representative: **Bonnetat, Christian et al,**
Cabinet PROPI Conseils 23 rue de Léningrad
F-75008 Paris(FR)

(54) Process of preparing breakfast cereals.

(57) Process of preparing particulate cereal grain containing at least one additive, which can be subsequently cooked for human consumption. The particulate cereal grain, which may be infested with insects, is treated in centrifugal impact milling apparatus. The centrifugal impact milling apparatus has a casing and a rotor rotatably mounted in the casing. The rotatable rotor is rotated at a peripheral velocity which is sufficient to cause destruction of the insect infestation in the particulate cereal grain by impelling by centrifugal force the particulate cereal grain in contact with the peripheral region of the rotor against the inner wall of the casing and/or impactors located inside of the casing but the centrifugal force is of such a magnitude as not to significantly decrease the particle range profile of the particulate cereal grain. The particulate cereal grain is removed from the centrifugal impact milling apparatus and the particulate cereal grain is mixed with at least one edible additive.



PROCESS OF PREPARING BREAKFAST CEREALS

The invention relates to the preparation of particulate cereal grain foods and to the destruction of insect infestations in particulate cereal grains.

5 The middlings produced in flour milling, essentially small pieces of endosperm free from bran and germ, are sold as farina and are often consumed as a breakfast food. Farina is usually enriched with vitamins and minerals and can be flavored. To reduce
10 cooking time, about 0.25 percent of disodium phosphate can be added; some products require as little as one-half minute of boiling before serving.

One known method of destroying insect infestation in milled grain is to heat the infested milled grain,
15 for example, wheat flores or wheat middlings, to a temperature sufficient to kill the insects, larvae and eggs. The heating step is expensive, can dehydrate the particles and can destroy some of the vitamin content of the particles. The heated milled grain is then mixed
20 with flavorants, vitamins and/or other additives. The resultant mixture, which is also at comparatively ele-

vated temperature is placed in boxes and sealed.

U.S. Patent No. 3,102,781 discloses a centrifugal impact milling apparatus for destroying insect infestation in particulate materials. The patent refers also to the use of the impact milling machine of the type disclosed in U.S. Patent No. 2,529,679. The centrifugal impact mill of U.S. Patent No. 3,452,937 is an improvement of the centrifugal impact mill of U.S. Patent No. 3,102,781.

U.S. Patent No. 2,339,737 discloses a centrifugal impact milling apparatus for destroying insect infestations in particulate materials. The patent states that it may be desirable to destroy the insect life or infestation without changing the character of the product in any manner, or it may be desirable to carry on a predetermined controlled process such, for example, as milling, blending, etc.

U.S. Patent No. 2,644,740 discloses a centrifugal impact milling apparatus for grain infestation destruction.

Other centrifugal impacting apparatus are disclosed in U.S. Patent Nos. 4,083,504; 4,022,749; 2,981,490; 3,229,923; 3,023,973; 3,171,604; 4,113,191; and 3,433,422.

U.S. Patent No. 3,463,313 discloses a centrifugal

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impacting mill particle classifier for milling soybeans and the like.

U.S. Patent No. 3,430,932 discloses contacting continuous and disperse phase substances using centrifugal and centripetal forces.

BROAD DESCRIPTION OF THE INVENTION

An object of the invention is to provide a non-thermal process of eliminating insect infestations in flour without significantly reducing the particle size profile or increasing the fines content of such flour. Another object of the invention is to provide an economical process for preparing particulate cereal grain containing additives, which can be cooked for human consumption. Other objects and advantages of the invention are set out herein or are obvious herefrom to one ordinarily skilled in the art.

The objects and advantages of the invention are achieved by the processes and composition of the invention.

The invention involves a process for destroying insect infestation in particulate cereal grain. The process includes treating the insect-infested particulate cereal grain in centrifugal impact milling apparatus. Preferably the treating step is conducted at room

or ambient temperature. The centrifugal milling apparatus has a casing and a rotatable rotor is rotated at a peripheral velocity which is sufficient to cause destruction of the insect infestation in the particulate
5 cereal grain by impelling by centrifugal force the particulate cereal grain in contact with the peripheral region of the rotor against the inner wall of the casing and/or impactors located inside of the casing. But the centrifugal is of such a magnitude as not to significantly decrease the particulate range profile of the
10 particulate range profile of the particulate cereal grain. Importantly, the amount of fines of the particulate cereal grain is not significantly increased.

Basically, the centrifugal impact milling apparatus
15 has a rotor with a plurality of impacting elements against which the particulate material to be processed is impelled by centrifugal force at high speed. Since milling is avoided in the invention process, it is probably more appropriate within the context of the
20 invention to refer to the apparatus as centrifugal impact apparatus.

In this invention, the centrifugal impact milling apparatus is operated at conditions so as to kill the insects, larvae and eggs without milling the cereal
25 grain particles. The procedure must be done in such a

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manner as to insure total destruction of any insect life present, regardless of form of the insect life. It is important to obtain proper distribution of the product in the treating area of the machine. To obtain total
5 destruction of the insects in the product, the product must be delivered to the impactors in the treating rotor in such a manner that every particle of the product as well as every insect, regardless of its stage of development, is engaged by one or more of the impactors. If
10 too much product is fed to the impactors per unit of time, there is the danger that the insect life will be cushioned and accordingly protected by the excess product and pass through the impactors unharmed. On the other hand, if the film of product delivered to the
15 impactors is too thin, the treating capacity of the machine is so greatly reduced as to make it uneconomical.

The critical criterion for the operation of the rotor of the centrifugal impact milling apparatus is the
20 peripheral velocity of the rotating rotor. The criterion is not expressed in revolutions per unit of time for the rotor because the desired centrifugal force is determined by the peripheral velocity of the rotating rotor. Peripheral velocity is dependent both upon the
25 radius of the rotor and the revolutions per unit of time

of the rotor.

The invention also includes a process for preparing particulate cereal grain containing at least one additive, which can be subsequently cooked for human consumption. The process includes treating the particulate cereal grain, which may be infested with insects, in centrifugal impact milling apparatus. Preferably the treating step is conducted at ambient or room temperature. The centrifugal impact milling apparatus has a casing and a rotor rotatably mounted in the casing. The rotatable rotor is rotated at a peripheral velocity which is sufficient to cause destruction of the insect infestation in the particulate cereal grain by impelling by centrifugal force the particulate cereal grain in contact with the peripheral region of the rotor against the inner wall of the casing and/or impactors located inside of the casing. But the centrifugal force is of such a magnitude as not to significantly decrease the particle range profile of the particulate cereal grain. The particulate cereal grain is removed from the centrifugal impact milling apparatus and then the particulate cereal grain is mixed with at least one edible additive. Preferably the mixing step is conducted at room or ambient temperature.

The processes of this invention are applicable to

any cereal grain flour, but is most advantageously used with wheat middlings. The cereal grain flour can be, for example, wheat flour, barley flour, sorghum flour, corn (maize) flour, oats flour, rye flour, rice flour and millet. The flour can be from non-cereal starch-yielding plants, for example, cassava flour (i.e., tapioca flour), soybean flour, potatoe flour and buckwheat flour.

The outer covering of wheat grain, which has been separated in extraction of the flour from the grain, is in a state of subdivision and is composed of bran and the finer, more floury outer coverings termed middlings. Depending on particle size profile, middlings are often termed coarse middlings and fine middlings.

The centrifugal impact milling machines are well known. In achieving grain infestation destruction in the invention process, grain or grain products such as middlings which may contain live insects is applied to the working area of the high speed rotor situated in a closed chamber or casing. In one form the rotor is connected at the bottom of a vertical shaft and rotates substantially in a horizontal plane. The rotor may consist of a solid circular bottom plate and an annular top plate which is supported on the bottom plate by a plurality of upstanding "impactors" disposed between the

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plates near the periphery thereof. The flour is fed to the bottom plate via an inlet in the casing which is coupled to a space between the inner edge of the annular top plate and the rotor shaft. A circular vertical wall or collar, sometimes known as the "distributor," depends from the lower surface of the top of the rotor casing to assist in preventing the flour from escaping from the processing action of the rotor. The speed of rotation of the rotor is such that the flour is impelled outwardly from the inlet area, between the rotor plates, into contact with the moving impactors at a velocity sufficient to kill the insects. If desired, a ring of stationary impactors can be placed surrounding the moving impactors.

While the film of the product is passing outwardly past the impactors, every minute particle thereof is violently engaged by one or more of the impactors. These impactors inflict upon the insect life severe physical mutilation with the resultant destruction of all of the insect life, regardless of its stage. This destruction is accomplished without significantly particle size profile reduction or fines increase.

The insect destruction is obtained by impacting actions which are produced within the treatment zone.

The rotor preferably is rotating at a peripheral

velocity of 7,000 to 10,000 feet per minute, more preferably 7,500 to 9,000 feet per minute and most preferably at about 8,000 feet per minute. Control of the amount of energy imparted to the infested wheat middlings is very important as the impact force must fit within the invention parameters.

It is important to prevent the production of fines as the presence of excessive fines in the final flavored product will cause the cooked product to gell and to be too starchy and gummy. The invention product has an excellent taste and texture. Preferably the impacting step does not increase the amount of fines or small particles in the particulate cereal grain more than 1.0 percent (and most preferably the increase is less than 0.5 percent). In the case of middlings, the amount of particles going through a 100 mesh sieve (U.S. Standard) should not be more than 2.5 percent. Basically the invention uses a rotor peripheral velocity which does not cause any affect as regards particle size.

The invention step of non-thermal insect infestation destruction is advantageous over the prior art in that it does not require an expensive heating step (to destroy the insects, larvae and/or eggs) and avoids drying out the particulate cereal grain.

The additives can be dried fruits, spices, other

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flavorants, etc.

Enrichment with minerals and vitamins is preferred. The ability to use a mixing step in which the middlings is at room temperature is a significant advantage over the prior art methods where the middlings were heated to 170°F. to destroy any insect infestation. Previously the hot middlings were mixed with additives, such as, minerals, vitamins and flavorants, and the mixture was put into boxes while at about 140°F. and the boxes sealed. The heat treatment can destroy some of the original vitamin content, which must be made up by vitamin addition. The mixing with the heated middlings can destroy or impair some of the added vitamins. This disadvantage does not exist with the invention process.

The invention further includes the particulate cereal grain containing additives, which can be subsequently cooked for human consumption, prepared by the process of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Figure 1 is a side elevation view of a typical centrifugal impacting machine, partly sectional;

Figure 2 is an enlarged fragmentary and sectional view of the rotor and its environment taken along the

line 2-2 shown in Figure 1;

Figure 3 is a fragmentary plan view of part of the rotor shown in Figure 2 looking in the direction of the arrows associated with the line 3-3 of Figure 2; and

5 Figure 4 is a plan view of the rotor shown in Figures 1, 2 and 3.

DETAILED DESCRIPTION OF THE INVENTION AND DRAWINGS

As used herein, all parts, percentages, ratios and proportions are on a weight basis and all temperatures
10 are expressed in degrees Fahrenheit, unless otherwise stated herein or obvious herefrom to one skilled in the art.

The invention process generally prepares edible cereal product prepared from at least one wheat farina
15 or farina-like product, preferably wheat middlings. The wheat used must have been subdivided into a reduced-size state, but preferably into the farina state. The farina used usually has an average particle size between about 20 to 40 mesh (U.S. Series). The Federal Specification
20 for farina requires that: 100 percent of the product passes through a U.S. Standard No. 20 woven-wire-cloth sieve; not more than 10.0 percent passes through a U.S. Standard No. 45 sieve; and not more than 3.0 percent passes through a U.S. Standard No. 100 sieve.

Flour by-products, derived from the outer coverings of the wheat grain separated in extraction of the flour from the grain, are bran and the finer, more floury outer coverings are termed middlings. The middlings produced in flour milling, essentially small pieces of endosperm free from bran and germ, are termed farina. The composition of middlings can vary a great deal depending on the wheat used and the amount of endosperm present. In the manufacture of farina, it is necessary to use hard wheat as a raw material since soft wheat yields a product which becomes excessively pasty upon cooking. A typical wheat coarse middlings contains 19.0 percent of protein, 5.8 percent of fat, 65.0 percent of carbohydrates, 6.0 percent of fiber and 4.20 percent of ash. A typical wheat fine middlings contains 18.0 percent of protein, 3.9 percent of fat, 73.1 percent of carbohydrates, 2.2 percent of fiber and 2.8 percent of ash.

The process of the invention can also be used to prepare cereal products from other than wheat farina. For example, cereal grains such as rice, barley, oats, rye, corn, millet, etc., can be used in the invention process in place of the wheat farina, or at least part thereof. Such cereal grains should be used in the particulate form which has a particle size within the

approximate particle size range of wheat farina.

In Figure 1, a supporting generally rectangular frame 9 is provided which includes four vertical cylindrical posts 10 (two of which, namely 10a and 10b are shown) to which four horizontal beams are connected, two of these beams running lengthwise of the structure and two running transverse thereto. One of the lengthwise beams is a beam 11a which is shown in full. Two cross-beams 11b and 11c are shown in section; the fourth lengthwise beam is not shown for simplicity of illustration. These beams are fixedly connected as by welding (or bolting) to four curved plates or sockets 12 (two of which, 12a and 12b, are pictured) which are curved to match the contour of the surfaces of the vertical columns 10a and 10b. The sockets are permanently affixed to 10a and 10b. The sockets are permanently affixed to the vertical columns by welding (or bolting) for example, as desired.

A heavy-duty motor 13 is bolted, as shown, to a vertical motor support member 14 having a horizontal portion 7 which rests on the longitudinal beams. Either the portion 7 or the longitudinal beams (or both) may have slots running lengthwise of the frame. A bolt assembly 8 extends through the slot in the portion 7 or in the beam to anchor the slides in the desired hori-

zontal position once adjustment of the spacing of the motor 13 from the rotary processing part of the apparatus has been made by means of the turnbuckle 34.

In order to support the rotary processing equipment there is also provided a spanning transverse Z-beam 15 connected at its ends, as by welding, to the two longitudinal beams 11. A rotor casing or chamber indicated generally at 16 depends from the supporting structure 9 by connections to the transverse spanning beam 15 and to the member 11c as is explained in detail below. The rotor casing 16 includes a top casing member 17 which is essentially cylindrical in shape. Connected to, and extending upwardly and outwardly from the top 17 are two input chutes one of which, designated by the number 18 (see also Figure 2), is on the side of the pulley shaft 30 toward the reader. There is an identical chute (not shown) on the other side of shaft 30. At the tops of, and connecting these two chutes is a horizontal rectangular plate section 19 integral with the chutes 18 which extends transversely of the longitudinal beam 11. Plate section 19 has a central round-apertured portion 43 through which the shaft 30 passes and two rectangular openings 22 for the chutes on either side thereof. To the plate section 19 a flanged input conduit (not shown) may be connected, for example, for supplying the mate-

rial in which the insect infestation is to be destroyed.

The plate 19 has apertures through which bolt 23, on the side of the shaft 30 toward the reader, and another bolt (not shown) on the other side of the shaft, are passed to suspend the top 17 of the casing 16 from the z-beam 15. The casing top 17 is also suspended from the transverse beam 11c by a bolt connection 21 to a C-beam 26 whose upper surface is fixedly connected, as by welding to the cross beam 11c.

The rotor casing 16 also includes a lower hopper portion 24 which is secured to the upper portion 17 by clamps 25 connected to the top and bottom members 17 and 24 at various points around the junction of the lower edge of the top portion 17 and the upper rim of the lower portion 24. These clamps 25 permit the casing 16 to be disassembled to allow access to the rotor 27, for example, or to permit the hopper 24 to be cleaned.

Referring now principally to Figures 1 and 2, a rotor 27 is located within the general confines of the top casing portion 17. Rotor 27 is keyed or otherwise attached to the lower shaft portion 28 which is a continuation of the upper shaft portion 30. The upper shaft portion 30 is mounted in a spindle assembly or yoke 35 consisting of two planar horizontal members 35a and 35c connected by an intermediate vertical member

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35b. Between the members 35a and 35c and mounted fixedly on the upper shaft portion 30 is a pulley sheave 31. The member 35c may be bolted or otherwise fixedly connected to the midsection of the plate section 19. The top end of shaft portion 30 is journalled in a top bearing assembly 29 and its lower end passes through lower bearing assembly 20.

Opposite the sheave 31 and parallel thereto is a sheave 32 fixedly mounted on the rotor shaft of the motor 13. Around both sheaves are disposed a plurality of belts 33 for transmitting energy from the motor 13 to the rotor 27. As previously mentioned, the horizontal spacing between the sheaves 31 and 32 and consequently the tension on belts 33 can be adjusted by turning the turnbuckle 34 connected to the plate 14 and to the spanning Z-beam 15.

As seen in the enlarged view of Figure 2 the rotor 27 consists of an essentially disc-like bottom plate 36 fixedly connected to the hub 45 which is mounted fixedly around the lower shaft portion 28. The rotor 27 also includes an annular upper plate 37 which is supported on the lower plate 36 by a series of movable vertical impactors 38. Impactors 38, which can be hollow cylindrical steel members, are fixed in place between upper and lower plates 37 and 36, by bolts 39 passing through

their bore which thread into apertures in the lower plate 36. The movable impactors 38 are disposed in a circular row near the outer edges of plates 36 and 37 (Fig. 4). In some models stationary impactors 40 are
5 arranged in a concentric row surrounding the row of movable impactors 38. Impactors 40 are fixedly (and preferably demountably) connected, as by bolts passing through them, which thread into holes in a liner 41 mounted near the peripheral vertical wall of the top
10 casing member 17.

When the motor 13 is in operation, the rotor 27 rotates at desired speeds which produce the desired peripheral velocities. Material to be de-infested is fed via the input chute 18 (and its counterpart on the
15 other side of the shaft 30) to the upper surface of the bottom rotor plate 36 near the hub 45. The input area is substantially segregated from the area where the impact infestation-destruction action occurs by a circular vertical collar (distributor) or wall member 35
20 which depends from the horizontal interior surface of the top 17 or which may actually be formed as part of the lower surface of top 17. This member 35 prevents the greater part of the incoming particulate material from moving upward and over the top plate 37 into the
25 hopper 24.

As may be seen by reference to Figure 2, the solid arrows indicate the direction of flow of the input material. As the rotor 27 spins, the applied material is hurled by the generated centrifugal force outward until it strikes the row of impactors 38 with force sufficient to kill any insect life within the material. In the case of flour, an insect known as the "confused flour beetle" often is an infestant but when the flour hits the impactors 38 the insects are destroyed. The flour impacted by the impactors 38 also strikes the outer row of impactors 40 which doubly insure that all insects passing through the processing area are destroyed, but such that there is no significant reduction of the flour particle size.

Since the bearings and the other mountings of the rotor 27 have finite tolerances and since the rotor may spin at high speeds, the components of the rotary motion may cause the axis of revolution of the rotor shaft 30 to wander sideways a bit. Consequently there is provided an annular space 42 of about 1/16" between the collar 35 and the inner edge of the top plate 37.

When the material to be applied is fed via the chutes 18 at a very high rate, an undesirably high number of live insects can be mixed in with the processed flour in the hopper 24. It was first thought

that the insects were able to get through the spaces between adjacent ones of the impactors 38. This is a case of the insect life being able to bypass the impacting area by going or being borne by air currents through the space 42, over the top rotor plate 37 and finally into the hopper 24. One way of correcting this trouble is to provide means considered but the one finally adopted was found to be associated with the rotation of the rotor 27 to generate a current of air in the space 42 in such a direction that insect life would not be able to move upwards and through. Accordingly, as shown in Figures 2, 3 and 4, eight solid bars 44 are mounted on the upper side of the top rotor annulus 37. The bars 44 are spaced equal distances from one another and arranged radially with respect to the hub 45. When the rotor 27 moved, the bars 44 cause an air current, as shown by the broken-line arrows in Fig. 2, to move down through the space 42 and then out toward and through the impacting region.

While the utility of the invention has been explained in terms of very small insects being borne through the space 42, it should be appreciated that insect eggs or larvae as well as adult insects are destroyed by the impactor milling apparatus.

Although the invention has been explained in

connection with one particular type of centrifugal impact-milling machine, it is just as applicable to other types having rotating impacting elements of different shapes and sizes, or different numbers of impactors, or different numbers and kinds of stationary impactors. For example, the centrifugal impact mill of U.S. Patent No. 3,452,937, which is an improvement of the above-described centrifugal impact milling apparatus, can be used if the grain is somewhat damp or moist.

Any suitable impact milling apparatus can be used in the invention process. Examples of suitable impact milling apparatus are those of U.S. Patent Nos. 3,102,781; 3,452,939; 4,083,504; 2,981,490; 2,644,740; 2,529,679; 3,229,923; 3,023,973; 3,171,604; 4,113,191; 3,433,422 and 2,339,737. While such impact milling apparatus are capable of milling grain or reducing the particle size of already-milled cereal, the invention process uses such impact milling apparatus in such a manner so as to destroy insect infestation in already-milled cereal without significantly reducing the particle size profile and increasing the fines of such already-milled cereal. A centrifugal impact milling apparatus is not used if it cannot meet the operational conditions and results required by the invention.

The pertinent portions of U.S. Patent No. 3,102,781

are incorporated herein by reference. U.S. Patent No. 3,102,781 discloses a centrifugal impact milling apparatus for grain infestation destruction. The centrifugal processing apparatus includes a rotor housed in a casing which is constructed to permit the passage through it of said materials for application to the rotor which thereupon impels the materials by centrifugal force to insect-destroying elements located toward the periphery of the rotor. The housing include a wall member between the elements and the area of the rotor to which the materials are applied. The wall member is separated from the rotor by a predetermined space having dimensions such that insect life in the applied material is able to pass through it and thereby avoids lethal contact with the insect-destroying elements. There is means for producing in the space a current of the violent atmosphere in a direction such as to prevent the insect life from escaping lethal contact with the insect-destroying elements.

The pertinent portions of U.S. Patent No. 2,339,737 are incorporated herein by reference. U.S. Patent No. 2,339,737 discloses centrifugal impact milling apparatus for destroying infestation in flour. The apparatus includes a base, a casing mounted on top of the base, a motor mounted in the casing and means for cooling the

motor during operation thereof. The motor has a heavy armature shaft. There is an anti-friction bearing secured to the casing for journaling the upper end of the shaft, a heavy anti-friction bearing housed in the base for journaling the lower end of the shaft, and means forming an oil seal about the shaft and the lower bearing. There is further a treating rotor secured to the lower end of the shaft, a casing secured to the under side of said base and surrounding the rotor, a product inlet conduit formed in the base and adapted to deliver the product to the rotor, and a distributor secured to the base adjacent to the upper central portion of the rotor and adjacent to the delivery end of the inlet for receiving the product from the inlet and for distributing it uniformly to the rotor. The delivery end of the distributor is positioned adjacent the center portions of the rotor. One portion of the delivery end of the distributor is further spaced from the rotor portion than that portion of the delivery end of the distributor immediately underlying the inlet.

The pertinent portions of U.S. Patent No. 2,529,679 are incorporated herein by reference. U.S. Patent No. 2,529,679 discloses an impact milling apparatus. The apparatus includes means forming a casing having a product-inlet opening at the top and a product-discharge

opening at the bottom, and a rotor mounted within the casing beneath the inlet opening and adapted upon rotation to subject the product particles to an impacting action against the side of the casing and to impart to the product particles rapid rotary movement. An inwardly tapering scouring shell is mounted beneath the rotor and is adapted to receive the product as it is discharged from the rotor and to direct the product downwardly in a thin unimpeded annular stream. There is conical surface forming means forming with the bottom of the shell an annular product-directing chute including baffle structure to stop the rotary movement of the product and to direct the product downwardly and radially-outwardly. There is also means forming an annular aspirating passageway exteriorly of the shell and including an annular aspirating gap at the exit end of the chute and across which the product flows. There is further means to flow a stream of air upwardly through the aspirating passageway and through the product at the gap.

The pertinent portions of U.S. Patent No. 2,644,740 are incorporated herein by reference. U.S. Patent No. 2,644,740 discloses a centrifugal impact milling apparatus for grain infestation destruction. The apparatus includes a rotor defining an annular treatment zone

through which the product flows to impart rotary movement thereof, and a downwardly extending casing construction surrounding the rotor and defining at the periphery of the rotor a discharge zone having an impact surface against which the rotating stream of the product passes. There is means forming a pair of separation hoppers beneath the zone and connected thereto. The means includes a separating wall member having openings therethrough and separating the upper portions of the hoppers directly adjacent and below said discharge zone whereby the rotating annular stream of the product passes along the separating wall with the smaller particles passing through the openings and with the larger particles passing downwardly along the wall.

The pertinent portions of U.S. Patent No. 3,452,937 are incorporated herein by reference. U.S. Patent No. 3,452,937 discloses a centrifugal impact mill wherein material processed by a high speed rotor is flung outwardly toward a surrounding gas-permeable wall member. To prevent adhesion of the material to the wall member, the latter is surrounded by a chamber to which air or other gas is fed under pressure. The gas is forced through the pores of the wall member toward the interior of the apparatus thereby tending to dislodge any material sticking to the inside surface of the wall member

or tending to repel such material before adhesion to the wall member. Means are provided within the apparatus for drawing off the gas from the interior.

5 The pertinent portions of U.S. Patent No. 3,229,923 are incorporated herein by reference. U.S. Patent No. 3,229,923 discloses a centrifugal impacting apparatus.

The pertinent portions of U.S. Patent No. 3,023,973 are incorporated herein by reference. U.S. Patent No. 3,023,973 discloses a centrifugal impacting apparatus.

10 The pertinent portions of U.S. Patent No. 3,171,604 are incorporated herein by reference. U.S. Patent No. 3,171,604 discloses a centrifugal impacting apparatus.

The pertinent portions of U.S. Patent No. 4,083,504 are incorporated herein by reference. U.S. Patent No. 15 4,083,504 discloses a centrifugal impacting machine.

The pertinent portions of U.S. Patent No. 2,981,490 are incorporated herein by reference. U.S. Patent No. 2,981,490 discloses a centrifugal impact milling apparatus.

20 The pertinent portions of U.S. Patent No. 4,113,191 are incorporated herein by reference. U.S. Patent No. 4,113,191 discloses a centrifugal impact milling apparatus.

The pertinent portions of U.S. Patent No. 3,433,422 25 are incorporated herein by reference. U.S. Patent No.

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3,433,422 discloses a centrifugal impact mill and subsequent particle classifier.

5 The suitable centrifugal impact milling apparatus allows treatment of or can be adapted to treat a product in such a manner that the infestation is physically mutilated and thereby destroyed. The physical mutilation is inflicted by passing the product through a treatment zone, and during this movement impacting, squeezing, or otherwise maltreating the various forms of
10 infestation. The treatment zone is formed by an annular rotor which is rotated at a sufficiently high speed and the product is fed to the center of the rotor and is thrown outwardly as a result of the rotation. It is important from a commercial standpoint to effect a total
15 destruction of the infestation, for if this treatment is anything less than 100 percent effective, the produce cannot be stored without danger of reinfestation. (The rotation of the rotor can move the particulates to and through the treatment zone.)

20 In destroying insect life in this manner, each portion of the product must be given a thorough treatment; however, it is important that the apparatus be used efficiently, as large quantities of the product must be handled and the apparatus must not occupy a large amount
25 of space. To obtain this thorough action in an effi-

cient manner, the entire rotor should be used at all times, and thus, it has been found that it is highly important to provide for the effective and dependable distribution of the product. For example, if the product is improperly distributed, with the result that an excessive quantity passes through one portion of the rotor, the product may cushion the mutilating action so that there is no complete life-destroying mutilation, and, as a result, some of the insect life may pass through the treatment zone without being destroyed. The possibility of such a cushioning action becomes more likely when the apparatus is being used to treat the product at the maximum rate. Furthermore, under such circumstances it is highly important that the product be properly distributed in order to prevent congestion in localized portions of the apparatus as such congestion might stop all flow.

The dry wheat farina or farina-like material, at this stage in the process, is mixed with additional ingredients, such as, vitamins, minerals, dried fruits, flavoring and antioxidants. Such additional ingredients should not usually be present in an amount greater than 40 weight percent, based on the total dry weight of the dry wheat farina or farina-like material. Vitamins, if added during the invention process, are preferably added

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to a dry composition. Usually salt (NaCl) in the amount of about 0.5 to 4.0 percent by weight is added, although some of the NaCl can be replaced by KCl.

Fortifying and other additives, flavoring, color-
5 ant, salt, sugars, minerals, wheat germ, cocoa, antioxidants and the like can be incorporated into the dried wheat middlings. The additives include B-complex vitamins, malt, soluble iron compounds, vitamin A, vitamin C, BHA and BHT. Also, non-fat dry milk solids,
10 (i.e., milk powder) or soybean protein may be added in an amount sufficient to create a final protein level of up to 10 to 20 percent. (About 0.25 percent of disodium phosphate can be added to reduce the cooking time of the final product.)

15 Further about 5 to 8 percent of at least one fruit can be incorporated into the dried, wheat material. The more popular dry or semi-dry fruits that can be used in the invention process include raisin, apple, apricot, blackberry, boysenberry, cherry, current, plum, elder-
20 berry, fig, gooseberry, grape, guava, loganberry, nectarine, peach, pear, pineapple, quince, raspberry, strawberry and other fruits or flavors. Also, an emulsifier does not have to be used in the process or product of the invention.

25 The preferred types of flavored final products are

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raisin, maple, apple cinnamon, apple raisin spice and raisin cinnamon.

The final flavored (or unflavored) product is usually placed in air-tight boxes in a conventional
5 manner.

The product can be cooked in water or milk for a few minutes to provide a flavored, cooked farina, which is usually eaten in a bowl with added milk (or water) and added sweetener.

10 By way of example, an insect-infested wheat middling (at room temperature) having the particle analysis:

15	Staying On Sieve, Mesh Size (U.S. Series)	<u>Weight Percent</u>
	on 30	47.8
	on 40	41.7
	on 100	8.6
	on 200 (pan)	0.9

is treated at room temperature in a centrifugal impact
20 milling apparatus using a peripheral velocity for the rotor of 8,000 feet per minute. The insect, larva and egg infestation in the wheat middlings is destroyed by the treatment. The treated wheat middlings has the particle analysis:

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	<u>Staying On Sieve, Mesh Size (U.S. Series)</u>	<u>Weight Percent</u>
5	on 30	46.9
	on 40	42.0
	on 100	9.2
	on 200 (pan)	1.1

The treated wheat middlings are mixed with raisins, minerals and vitamins at room temperature and then are boxed in air-tight containers. One box is opened, one cup of the contents is mixed with one-third cup of water, is cooked for 3 to 5 minutes and mixed with milk and sugar in a bowl. The cooked material has an excellent taste and texture and is not gummy, lumpy or starchy.

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WHAT IS CLAIMED IS:

1. Process for destroying insect infestation in particulate cereal grain comprising treating said insect-infested particulate cereal grain in centrifugal impact milling apparatus, said centrifugal milling apparatus having a casing and a rotor rotatably mounted in said casing, said rotatable rotor being rotated at a peripheral velocity which is sufficient to cause destruction of said insect infestation in said particulate cereal grain by impelling by centrifugal force said particulate cereal grain in contact with the peripheral region of said rotor against the inner wall of said casing and/or impactors located inside of said casing, but which is of such a magnitude as not to significantly decrease the particulate range profile of said particulate cereal grain.

2. Process as claimed in Claim 1 wherein said particulate cereal grain is infested with insects, insect larvae and/or insect eggs.

3. Process as claimed in Claim 2 wherein said particulate cereal grain is wheat middlings.

4. Process as claimed in Claim 3 wherein said centrifugal force has a magnitude which does not significantly increase the amount of the smaller particles or fines of said particulate cereal grains.

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5. Process as claimed in Claim 3 wherein said peripheral velocity of said rotor is from about 7,000 to about 10,000 feet per minute.

6. Process as claimed in Claim 3 wherein said peripheral velocity of said rotor is from about 7,500 to about 9,000 feet per minute.

7. Process as claimed in Claim 3 wherein said peripheral velocity of said rotor is about 8,000 feet per minute.

8. Process as claimed in Claim 3 wherein said insect-infestation destruction step is conducted at or about room temperature.

9. Process of preparing particulate cereal grain containing at least one additive, which can be subsequently cooked for human consumption, comprising:

(a) treating said particulate cereal grain, which may be infested with insects, in centrifugal impact milling apparatus, said centrifugal impact milling apparatus having a casing and a rotor rotatably mounted in said casing, said rotatable rotor being rotated at a peripheral velocity which is sufficient to cause destruction of said insect infestation in said particulate cereal grain by impelling by centrifugal force said particulate cereal grain in contact with the peripheral region of said rotor against the inner wall of said

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casing and/or impactors located inside of said casing, but which is of such a magnitude as not to significantly decrease the particle range profile of said particulate cereal grain; and

- 5 (b) removing said particulate cereal grain from said centrifugal impact milling apparatus and mixing said particulate cereal grain with at least one edible additive.

10 10. Process as claimed in Claim 9 wherein said particulate cereal grain is infested with insects, insect larvae and/or insect eggs.

 11. Process as claimed in Claim 10 wherein said particulate cereal grain is wheat middlings.

15 12. Process as claimed in Claim 11 wherein said insect-infest destruction step and said mixing step are conducted at or about ambient temperature.

20 13. Process as claimed in Claim 11 wherein said centrifugal force has a magnitude which does not significantly increase the amount of the smaller particles or fines of said particulate cereal grains.

 14. Process as claimed in Claim 11 wherein said peripheral velocity of said rotor is from about 7,000 to about 10,000 feet per minute.

15. Process as claimed in Claim 11 wherein said peripheral velocity of said rotor is from about 7,500 to about 9,000 feet per minute.

5 16. Process as claimed in Claim 11 wherein said peripheral velocity of said rotor is about 8,000 feet per minute.

17. Process as claimed in Claim 11 wherein said mixture is placed in at least one box and said at least one box is sealed.

10 18. Process as claimed in Claim 11 wherein said boxing step is conducted at or about ambient temperature.

15 19. Particulate cereal grain containing at least one additive, which can be subsequently cooked for human consumption, prepared by the process of Claim 1.

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Neu eingereicht / Newly filed
Nouvellement déposé

Fig. 1

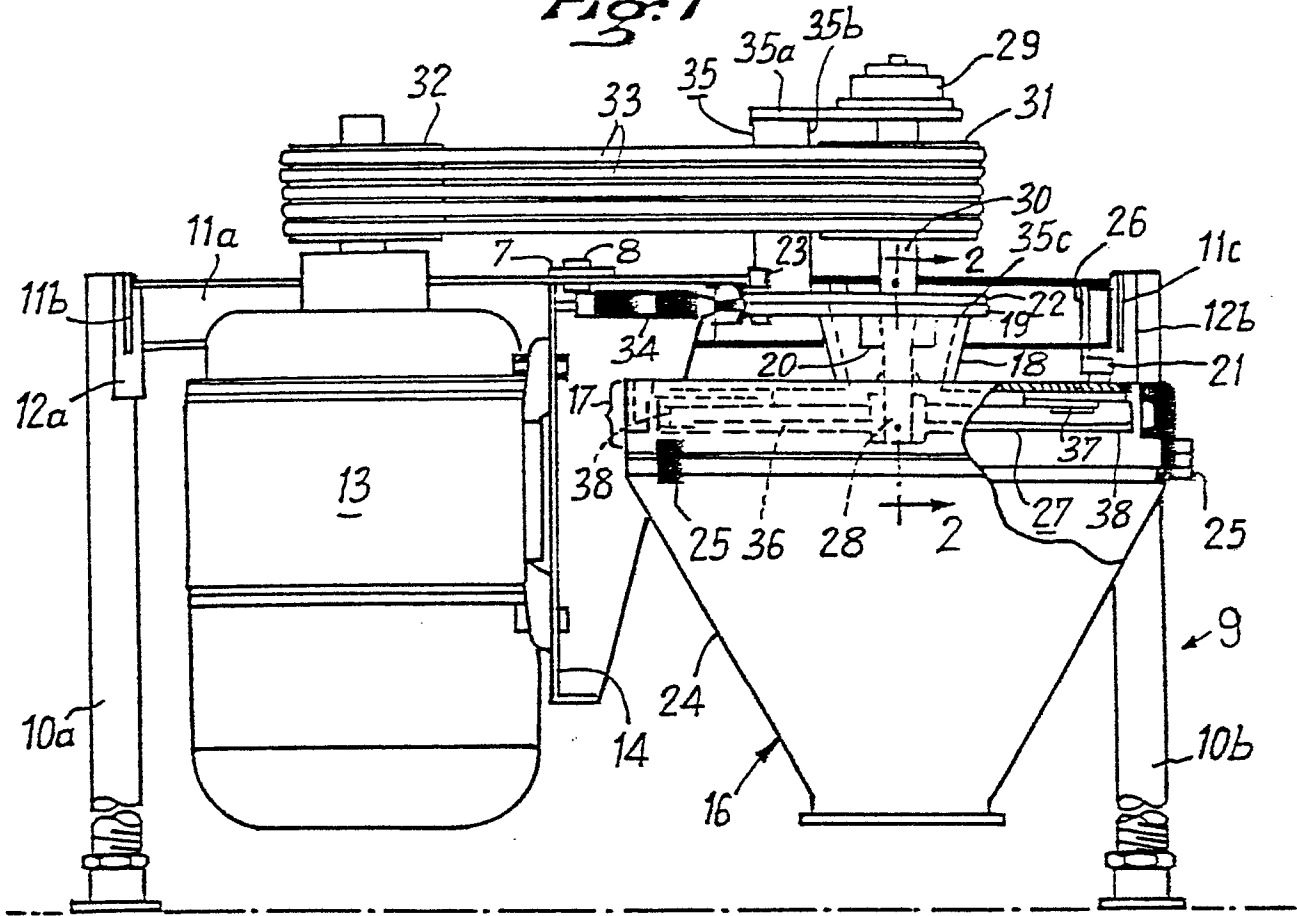


Fig. 3

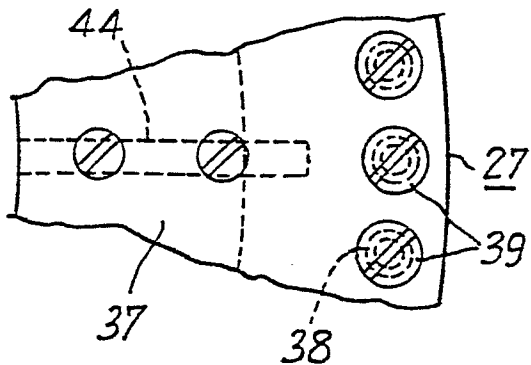


Fig. 4

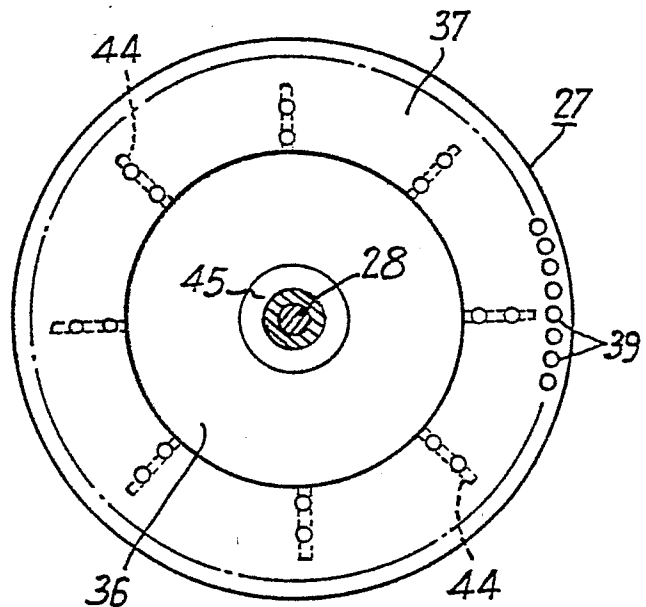


Fig. 2

