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(54) **Method of skinning and cutting product and apparatus therefor.**

(57) A method and an apparatus for skinning and cutting wet grain has a hopper 10 supplying wet, cooked grain via a feed channel 11 to a hopper 9. The hopper 9 is connected to feed grain to one end of a perforated cylinder 1. Located within the cylinder is a shaft 3 rotatable by a motor 5, the motor being controlled by a variable speed device 7. The shaft 3 carries a plurality of axially spaced rectangular knives 4, adjacent knives being oriented at approximately 90° to one another. In use wet grain entering the cylinder is bruised and the skins of the grain are weakened and removed to fall through the cylinder perforations, and the thus skinned grain is subsequently cut by the knives until of such a size that the grain passes through the cylinder perforations 2. The skins and grain are sorted by blowing and the cut grain is dried for subsequent use.

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METHOD OF SKINNING AND CUTTING PRODUCT AND APPARATUS THEREFOR

This invention relates to a method of skinning and cutting product and an apparatus therefor and in particular, although not exclusively, to a method and cutter for cutting wet grain.

Bulgur or Cracked Wheat is a middle eastern food traditionally made for centuries from durum wheat by harvesting, farm cooking and sun or soil drying for about one to seven days. Further processing involves storing the wheat for two or three days for it to harden, re-wetting the wheat for a few minutes such that the skin is softened but not the grain so that the skin can be removed, skinning the grain by rubbing the skin against the hardened grain, cutting the grain and then re-drying, cleaning and bagging. The significant number of people from the middle east and Turkey now residing in the E.E.C. has led to an increase in importation of this product from Turkey and Lebanon. In 1989 for example, it is estimated that 1,000 tonnes were imported to the UK alone. Typically shipping containers are used holding 20 tonnes of Bulgur in 50 kg polypropylene bags which are then distributed in small quantities for re-bagging and retailing. Consumers either boil the material to produce "pilaf", a dish similar to rice, or cold soak the product for salads.

Because of the concern for improved hygiene of the imported product it has been decided by the applicants to produce durum wheat for production of Bulgur in the UK to overcome the high transportation costs and to overcome doubts concerning hygiene. A plant for producing Bulgur was initially constructed in the UK which simulated the process carried out in the middle east consisting of a large pressure cooker and batch grain dryer, a revolving wetting drum, skinner/cutter and a large tumble dryer.

It was however found that the steps of skinning and cutting re-wetted grain caused a severe dust and noise problem together with a considerable amount of machine wear. Stones tended to chip off a grinding wheel used in the skinner/cutter and the stones found their way into the product although they were subsequently eliminated by gravity tabling. Without the initial sun/drying process, the cost of drying 40% moisture cooked durum to 10% for re-wetting, skinning and cutting and then drying again from 25% moisture to 10% moisture is very high. Furthermore the waste factor of skin dust and unsellable undersize particles was over 20%.

The present invention seeks to at least partially mitigate the foregoing difficulties and disadvantages.

According to one aspect of this invention there is provided a method of skinning and cutting a product including the steps of softening the product skin by wetting, supplying said wetted product to a perforated cylinder having a rotatable skinning and cutting means mounted therein, said skinning and cutting means being adapted to skin the product and subsequently cut the product to a predetermined size.

In currently preferred embodiment the product is durum wheat grain and the method further includes cooking the grain prior to supplying the grain to said cylinder, sorting the cut grain from skin, and drying cut grain of predetermined size for use.

According to a feature of this invention there is provided an apparatus for use in the method of including a perforated housing, rotatable cutting means located within the housing, means for supplying wet, cooked grain to the housing in a direction generally co-axial with the rotatable cutting means, and means outside the housing for collecting skinned, cut grain emerging through the perforations.

Advantageously motor control means are provided for rotating the knives at a range of speeds from 0 to 10,000 RPM and in a currently preferred embodiment the knives are mounted on a shaft driven by said motor control means. Preferably, adjacent knives are displaced by approximately 90° with respect to one another.

Conveniently hopper feed means are provided for feeding product to one end of said cylinder and advantageously said hopper feed means is provided with a regulator for controlling the amount of product fed to the cylinder.

By use of the apparatus of this invention the grain is cut while still wet and soft after cooking so that the problem associated with the prior art of dust, noise and machine wear is reduced and the product is dried only once thereby saving energy over the prior art. The water content of the cooked grain is typically 25-45% by weight, e.g. 35 to 43%. Moreover since the grain is cut into smaller pieces prior to drying so more efficient drying takes place than when whole grain is dried as in the prior art since in the prior art the skin tends to retain moisture in the grain after cooking and also because the cooked grain of the prior art has a larger mass. Additionally the waste factor of skin and minimal small pieces is reduced to approximately 10% and the process can be effected in a matter of hours rather than days as in the prior art. Additionally hygiene is improved by the fewer steps being involved.

The invention will now be described by way of example with reference to the accompanying drawing which shows in partial section a schematic view of the apparatus for cutting grain in accordance with this invention.

The apparatus shown in Fig. 1 of a trial plant has a stainless steel cylinder 1 with a plurality of perforations 2 in the wall thereof, the perforations being of a required, predetermined size, for example of 3mm diameter for Bulgur. For a cylinder of dimensions

30cm long and 12cm diameter, there are preferably 4,000 perforations. Located within the cylinder is an axial shaft 3 along which are equiaxially spaced, rectangular high carbon or mild steel knives 4, adjacent, knives being oriented at approximately 90° to one another and traversing a major portion of the cylinder diameter. Pairs of adjacent knives are shaped for example by having respective cutting edges facing one another, for reasons explained hereinafter. Advantageously about two knives per 5cm of cylinder length are provided.

One end of the shaft 3 is connected to a drive motor 5 via a reduction gear box (not shown), the motor 5 and gear box being located within a unit 6. The other end of the shaft and of the cylinder is supported by a member 12. The motor is connected via an optional controller 7 by a lead 8 to an electricity supply source. The controller 7 is conveniently a phase inverter for controlling the speed of rotation of the cylinder 1 from 0 to 10,000 RPM so that an operator can set the precise speed required for optimum skinning of grains. The controls may be programmed to reverse the rotation of the cylinder or to provide a fluctuating speed pattern to reduce the possibility of localise clogging of grains within the cylinder.

The unit 6 is connected to a feed funnel 9 which feeds into the cylinder 1 and the funnel 9 is arranged to receive grain from a feed hopper 10 via a vibrating feed channel or a variable speed worm feed 11. The feed channel 11 is able to control the quantity of grains fed to the cylinder 1, the optimum setting being a compromise between speed and the need for grains to be able to rebound freely within the cutting cylinder.

In operation, durum wheat is cooked by boiling with water and the wheat while still wet is fed into the hopper 10. The wheat may be fed into the hopper 10 while still hot or it may be allowed to cool. The wheat is fed via the feed channel 11 and funnel 9 to one end of the cylinder 1.

While we do not wish to be bound by theory, it is believed that due to the high knife speed, grains do not make good contact with the knives because the knives move too quickly. Additionally, due to the paired arrangement of the knife blades, so grains are knocked back and forth between adjacent pairs of the knives whereupon the skins are bruised, eventually crack and are removed through the cylinder perforations. The perforations in the surface of the cylinder also ensure that the grains are continually rubbed to weaken their skins. Once the grain is free of its protective skin it loses its strength and ability to bounce off surfaces and is then susceptible to the cutting action of the knives.

The at least partially skinned grains are now cut by the revolving knives. The perforations in the cylinder wall are of a required particle size so that only grains having a size less than the predetermined size can leave the cylinder. The result of this cutting and sieving action is that the particles size of the grains has a small tolerance and avoids the normal spread of particle sizes in the prior art which gives rise to under and over cutting and which requires further grading.

The grains and skins are sorted by blowing the skins away to leave the cut grains which are then dried to 10% moisture and bagged.

A range of cutting cylinders 1 is preferably provided so as to produce exactly the required particle size for a given product. The control 7 for the motor 5 is an important part of the apparatus since not only do grain lots vary in physical properties but the method of cooking and degree of over or under cooking affects the skinning and cutting properties of the grain so that the motor is controlled in dependence upon specific requirements.

The apparatus of this invention facilitates wet grain skinning and cutting which not only provides energy saving but also simplifies the manufacturing process of Bulgur by eliminating drying on two occasions and eliminates double handling. With the apparatus of this invention Bulgur can be made in a matter of hours instead of days with the consequent saving in floor space utilization and improved hygiene. Although described in relation to skinning and cutting durum wheat, it is envisaged that the invention may have applicability to other grain products where a similar skinning and cutting operation is required, e.g. oats, rye and rice.

Claims

1. A method of skinning and cutting a grain product including the steps of wet cooking the grain, passing the wet cooked grain through rotating cutting and skinning means located within a perforated housing and recovering skinned cut grain pieces emerging through the perforations, one size of the emerging pieces being determined by the size of the perforations.

2. A method according to claim 1 wherein the cut grain is separated from the skin and is dried.

3. A method according to claim 1 or claim 2 applied to durum wheat.

4. A method according to any of claim 1 to 3, in which the cutting and skinning means include rotary knives.

5. A method according to claim 4, in which the grain is passed through the housing substantially axially to the rotary knives, and the cut grain emerges substantially radially through the perfor-

ations.

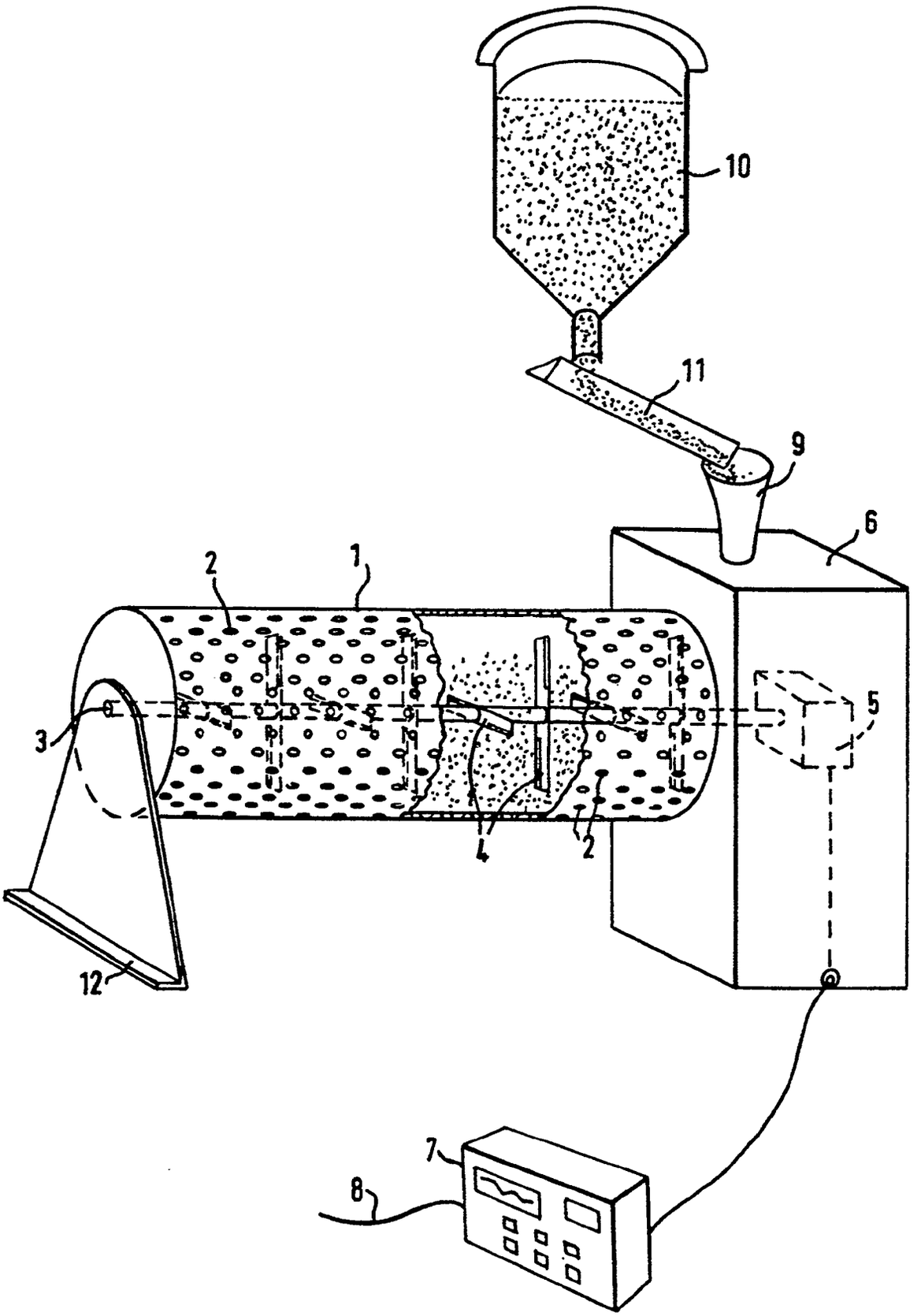
6. Apparatus for use in the method of claim 1 including a perforated housing, rotatable cutting means located within the housing, means for supplying wet, cooked grain to the housing in a direction generally co-axial with the rotatable cutting means, and means outside the housing for collecting skinned, cut grain emerging through the perforations.

7. Apparatus according to claim 6, in which the cutting means are knives extending radially from an axial shaft.

8. An apparatus as claimed in claim 7 wherein the knives are mounted on a shaft driven by said motor control means, adjacent knives being displaced by approximately 90° with respect to one another.

9. An apparatus as claimed in claim 7 or claim 8 wherein the knives are equi-spaced along said shaft and each knife traverses a major portion of the cylinder diameter.

10. An apparatus claimed in claim 9, wherein adjacent pairs of knives are rectangularly shaped and pairs of adjacent knives are adapted such that product with skins attached thereto is knocked back and forth between said knife pairs.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