APPARATUS FOR AND METHOD OF REMOVING PULP FROM A BANANA
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ABSTRACT OF THE DISCLOSURE

The apparatus disclosed herein acts to take a whole banana and introduce one end of it into a gap between a pair of counter-rotating cylinders. The cylinders pull the peel of the banana therebetween and, in so doing, burst the banana peel and extrude pulp therefrom. The cylinders draw the banana peel through the gap formed therebetween and deposit it into a suitable receptacle. The banana pulp is directed by the front of the cylinders onto a conveyor where it is moved to a subsequent processing station.

BACKGROUND

The increasing demand for various types of prepackaged and convenience type food products has placed an increasing demand on the manufacturers and processors of such products with the resulting problem of increasing production. This problem is not easily resolved since increased production requires techniques of food processing not necessary for lower production requirements. Some of these problems are not readily apparent at first. Typical of such "hidden" problems is the peeling of bananas for use in such food products.

Manual peeling of bananas is expensive due to the hand labor involved, time-consuming and, at best, a tedious task. Such manual operations certainly are not suitable for high production operations. However, since it is the banana pulp that is the usable ingredient, the peel must be removed before the banana can be used as an ingredient in a food product.

SUMMARY

In accordance with the present invention, there is provided a method of automatically removing the pulp from within the banana peel efficiently and rapidly without requiring complicated machinery.

The pulp of the banana is collected in accordance with the present invention by progressively exerting pressure on a whole banana from one end of the banana towards the other end to extrude the pulp from the banana without any previous treatment of the individual banana other than removing it from the bunch. The extrusion of the banana pulp is effected by passing the banana between pressure applying members. The pulp is extruded intact and is separated from the peel on the front side of the pressure members as the peel is pulled through and discharged on the rear side thereof.

Apparatus suitable to practice this method includes a pair of adjacent, spaced apart, driven counter-rotating cylinders having generally parallel axes. One end of a whole banana is introduced between the cylinders, the surfaces of which grip the banana and pull it into the gap between the cylinders. As the banana is pulled between the cylinders, the cylinders press against the banana and extrude the banana pulp out of the peel.

The cylinders pull the banana peel through causing the pulp to separate from the peel and drop in front of the cylinders while the peel is discharged on the back side of the cylinders.

In order to facilitate high production rates, the individual bananas are introduced into the cylinders by an automatic conveyor system. The discharge end of such a conveyor system is disposed adjacent the front side of the cylinders and is spaced therefrom by a distance less than the length of a banana. This spacing allows the conveyor to introduce the banana between the cylinders while providing a space for the banana pulp discharged in front of the rollers. The banana pulp is then carried away for subsequent processing. In order to insure the maintenance of the proper orientation of the banana on the conveyor feed belt, with the end of the banana facing towards the cylinders, one or more idler rollers are disposed above the conveyor belt and positioned to apply light pressure to bananas being advanced by the belt.

The present invention thus provides a method for collecting the pulp of a large number of bananas automatically and at rapid rates without the necessity of utilizing manual labor to perform this tedious and monotonous task. Additionally, a plurality of such apparatuses can be operated in an integrated system whereby the banana pulp can be discharged onto an out feed conveyor and automatically transferred into the next step in the food processing system.

Collecting of the banana pulp is performed in the present invention without the necessity of having to cut or slice the banana first, and, therefore, there is very little likelihood that a portion of the banana peel will remain attached to the pulp. At least as much pulp, if not more, can be removed from the banana peel as compared to the amount obtained by manually peeling the banana, and it can be removed faster. This removal of the pulp is effected while maintaining the pulp intact. This is advantageous as it allows the pulp to be used as desired, for example, in the form of banana slices or pieces.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and of one embodiment thereof, from the claims, and from the accompanying drawings in which each and every detail is shown is fully and completely disclosed as part of this specification, in which like reference numerals refer to like parts, and in which:

FIGURE 1 is a perspective view of an apparatus of the present invention;

FIGURE 2 is a diagrammatic perspective view showing the position of the banana relative to the extruding cylinders as the banana is introduced into the space between the cylinders;

FIGURE 3 is a perspective view similar to FIGURE 2 showing the pulp being extruded and removed from the banana; and

FIGURE 4 is a diagrammatic plan view showing how apparatus could be arranged as part of an integrated food processing system.

In the banana pulp removal apparatus of the present invention a banana 10 is placed on a generally horizontal moving conveyor belt 12. The banana 10 is oriented with one end, usually the stem 14, of the banana extending in the direction of the belt travel.

In order to maintain the banana 10 in proper orientation as it enters the discharge portion 15 of the conveyor 12, one or more free running idler rollers 16 are supported above the belt 12 near the discharge end 15. The idler rollers 16 are spaced above the belt 12 a distance sufficient to allow them to exert a slight pressure on the banana 10 as it passes under the rollers 16. The rollers 16 prevent the banana 10 from tipping over the end of the conveyor belt 12 before being introduced into the cylinders 18. Furthermore, the slight pressure exerted by the rollers 16 on the banana 10 is sufficient to maintain the
The removal of the pulp \(10a\) from the banana \(10\) is effected by a pair of generally horizontal cylinders \(18\) having generally parallel axes. The cylinders are spaced from each other to define a gap \(20\) therebetween which is less than or equal to twice the thickness of the banana peel \(10b\), for example, approximately \(\frac{1}{6}\) inch. The cylinders \(18\) are spaced from the end of the feed conveyor belt \(12\) by a distance somewhat less than the length of the bananas being processed to insure that the bananas will be introduced into the cylinder gap \(20\).

The cylinders \(18\) are both driven in counter-rotating directions by a suitable power means (not shown), such as an electric motor. It is desirable for the surface speed of the cylinders \(18\) to be faster than the speed of the conveyor belt \(12\) so that the cylinders \(18\) pull the banana \(10\) off of the conveyor belt as the one end of the banana \(10\) is introduced between the cylinders \(18\). The gap \(20\) between the cylinders \(18\) allows the banana peel \(10b\) to be pulled into and through the cylinders while applying sufficient pressure to extrude the pulp \(10a\) of the banana from the peel \(10b\).

Referring to FIGURE 2, there is shown diagrammatically the typical position of a banana \(10\) with its stem \(14\) being introduced between the cylinders \(18\). As the cylinders \(18\) pull the banana \(10\) into the gap \(20\), pressure is progressively exerted on the banana \(10\) from the one end. In this case the stem end \(14\) toward the other end. This pressure causes the banana peel to progressively split along one side of the banana, and causes extrusion of the whole banana pulp \(10a\) out of the banana peel \(10b\).

The pulp \(10a\), being at once firm and slippery, is pushed out of the split peel \(10b\) to one side along the cylinders \(18\) as seen in FIGURE 3, rather than being pulled through the cylinders. When the pulp \(10a\) is free of the peel \(10b\) it falls in front of the cylinders \(18\) onto a suitable conveyor system \(24\) which carries the pulp away, typically for use in a food processing system.

At the same time, the now empty banana peel \(10b\) is pulled through the cylinders \(18\) and is discharged on the rear side of the cylinders \(18\) in any suitable container \(26\).

The characteristics of banana peels and the pulp have a tendency to cause the surface of the cylinder \(18\) to become slippery, thereby reducing the frictional force between the cylinders to a point where they no longer are able to pull the banana peel through. In order to retain the desired frictional force, the surfaces of the cylinders are kept clean. The surfaces can be cleaned, for example, by sprayers \(28\) dispensing a cleaning solution onto the rear of the cylinders \(18\) and/or by suitable scraper blades \(30\) positioned adjacent the cylinders \(18\) to remove excess cleaning solution and any material clinging to the cylinders. The maintenance of sufficient frictional force is important since the surfaces of the cylinders are smooth to allow the pulp \(10a\) to slide along the front side of the cylinders without being pulled through.

Because of the simplicity of the construction of the banana peeling apparatus of the present invention, a plurality of such banana peelers can be incorporated in an integrated system as seen in FIGURE 4, wherein a plurality of individual apparatuses are disposed side by side with the banana pulp from each apparatus being discharged onto a conveyor belt \(24\) which carries the pulp \(10a\) to a single distribution point.

Thus, there has been disclosed a simple procedure for automatically and rapidly removing the pulp from the banana and simultaneously discharging the banana peel into a suitable location while supplying the banana pulp, as desired, to a food processing system.

The novel method herein disclosed involved the introduction of a banana into a device which progressively applies pressure to the banana starting at the one end and moving towards the other end of the banana. The resulting pressure causes the banana peel to split and results in the extrusion of the pulp from within the banana while simultaneously preventing the banana peel from being supplied along with the banana pulp.

Typically, such banana peeling provides a yield at least as good as that achieved by manually peeling bananas and removing the pulp therefrom and, at the same time, allows for supplying the banana pulp intact at a rate considerably in excess of that possible when done manually.

It will be readily observed from the foregoing detailed description of the invention and in the illustrated embodiments thereof that numerous variations and modifications may be effected without departing from the true spirit and scope of the novel concepts and principles of this invention.
whereby the pulp is extruded out of said banana and removed from the peel on said one side of said cylinders and the banana peel is pulled through and discharged from the cylinders on said other side.

9. Apparatus for removing pulp from a banana comprising in combination a pair of cooperable rotatable cylinders defining a gap therebetween, means for introducing a whole banana, one end first, into the gap between said cylinders, means for rotating said cylinders, means for cleaning the surfaces of said cylinders whereby frictional forces sufficient to pull a banana peel through the cylinders are maintained, the surfaces of said rotating cylinders gripping and pulling the banana introduced therebetween from one side thereof to the other side thereof while applying pressure to the banana, whereby the pulp is extruded out of said banana and removed from the peel on said one side of said cylinders and the banana peel is pulled through and discharged from the cylinders on said other side.

10. Apparatus for removing pulp from a banana comprising in combination a pair of spaced apart cylinders having generally parallel axes and defining a gap therebetween less than twice the thickness of a banana peel, conveyor means disposed adjacent to and spaced from said pair of cylinders for transporting a whole banana placed thereon towards said cylinders, one end first, and for introducing said one end of the banana into the gap between said cylinders means associated with said conveyor for maintaining the orientation of the bananas placed on said conveyor, means for counter-rotating said cylinders to pull a banana introduced into said gap through and to simultaneously exert pressure upon said banana, whereby the banana pulp is extruded from the banana peel and drops in front of said cylinders while said empty banana peel is pulled through the gap and discharged from the cylinders on the rear side thereof, and means for cleaning the cylinders of excess material adhering thereto.

11. Apparatus claimed in claim 10 in which said orientation maintaining means comprises at least one free running idler roller disposed above said conveyor a distance less than the thickness of a banana.

12. Apparatus as claimed in claim 10 in which said cylinder cleaning means includes a scraper blade disposed adjacent the rear surface of said cylinders and spray means for washing the surfaces thereof.

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