United States Patent

[11] **3,550,526**

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[54] **CONTINUOUS JUICE EXTRACTOR**
2 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **100/37,** 100/90, 100/117, 100/211
[51] **Int. Cl.** **B30b 9/22**
[50] **Field of Search** 100/37, 107, 110, 116, 117, 122, 211, 212, 126, 90, 165, 146; 146/236; 18/12SJ

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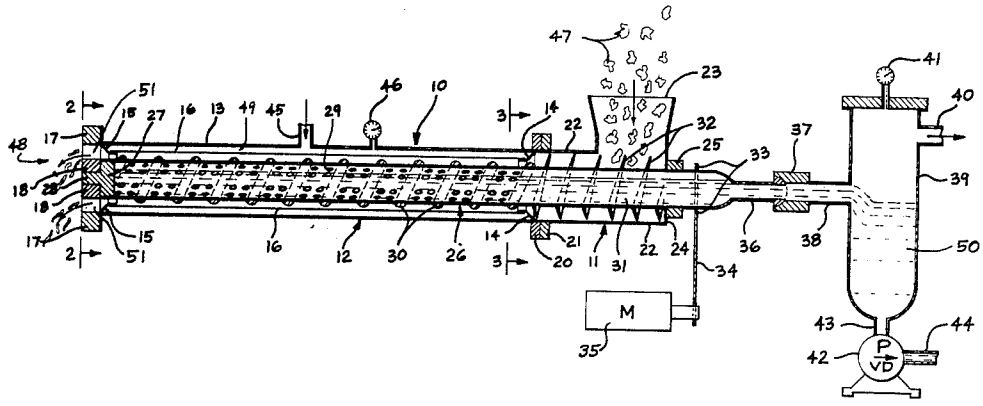
ABSTRACT: In abstract, a preferred embodiment of this invention is a continuous operation juice extractor using a perforated screw conveyor to move the pulp through the device. A flexible sleeve or bladder applies selectively either constant or varying pressures to the perforated screw conveyor to press the juice from the pulp. A vacuum may be applied to the hollow center portion of the perforated screw to assist in removing the juices therefrom as well as deaerate the same.



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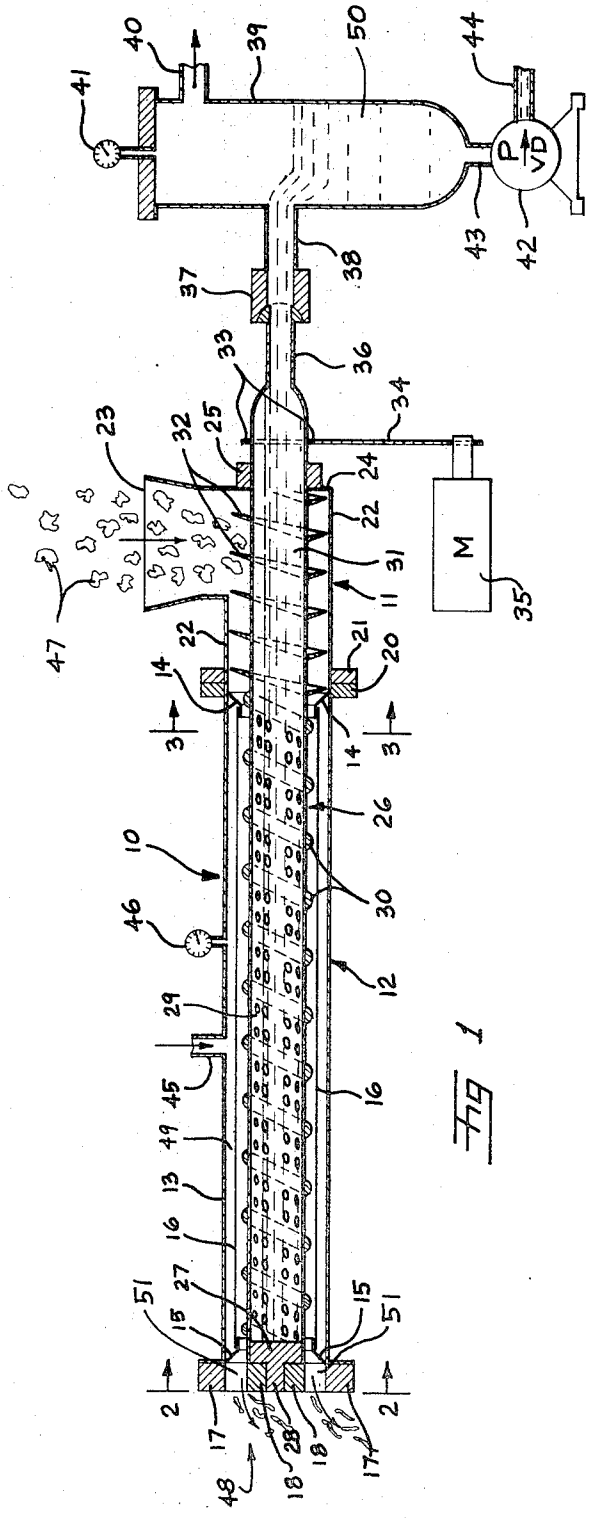

FIG 1

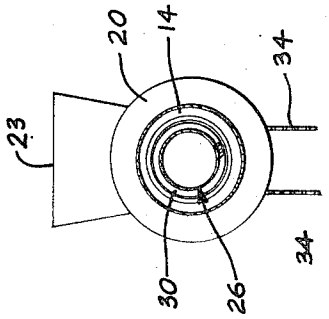

FIG 3

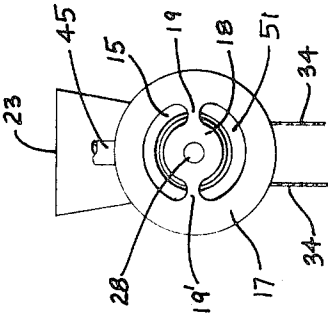

FIG 2

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CONTINUOUS JUICE EXTRACTOR

DESCRIPTION

This invention relates to food-processing equipment and more particularly to devices for extracting liquids from the fruit of various types of vegetation.

In the past, various types of juice-extracting devices for apples, grapes, celery, tomatoes, oranges, grapefruits and the like have been developed in an effort to not only obtain a maximum separation of pulp from liquid but also to process as large quantities as possible with a minimum expenditure for equipment and processing plant space.

Up until now, the most efficient type of liquid separator has been the press-type wherein the product is placed between two coacting surfaces, pressure is applied to force the liquid from the pulp, the pressure is released, and the remaining solid material removed. This four-step cycle of loading, pressing, unloading and reloading, although efficient in separation, is highly inefficient when the labor force required is compared to the amount of product processed.

To overcome the inherent production limitations of press-type extractors, attempts have been made to devise continuous feed extractors. Pairs of coacting screws have been used as well as tapered revolving screws coacting against tapered screens to build up adequate pressure to separate the liquid from the solid product. All of these continuous feed extractors, however, have been highly inefficient at best with relatively larger amounts of liquid remaining within the solid product when the same is ejected from the system.

Thus it can be seen that until now the juice-extracting industry has been in the dilemma of having to use the time-consuming batch process to obtain any degree of efficiency of separation or use the continuous feed-type extractor with very low efficiency.

The present invention has been developed after much research and study into the above-mentioned problems and is designed to give extremely high efficiency in the percentage of separation while at the same time allowing continuous operation to be accomplished. To do this, applicant has devised a novel conveying and pressing system which allows the compression to be varied according to the pressures necessary to extract the maximum amount of liquid from products of varying density and compositions. A means has also been provided for assisting the flow of liquid from the system and to deaerating such liquid to better preserve its flavor and color.

It is an object, therefore, of the present invention to provide a continuous operation juice extractor pressure-adjusting means to assure maximum separation efficiency.

Another object of the present invention is to provide in a continuous operation liquid extractor combination means for assisting in the removal and deaeration of the separated liquid from the extractor unit.

A further object of the present invention is to provide an efficient, continuous operation liquid separator which is simple in construction and inexpensive to manufacture and maintain.

An additional object of the present invention is to provide a juice extractor having the efficiency of operation of the batch-type press extractor with the speed of the continuous operation-type extractor.

Another object of the present invention is to provide a continuous operation juice extractor capable of applying controlled pressure on one side of the product and applying a vacuum on the other side of the product thereby increasing the efficiency of juice extraction from the pulp solids.

Other objects and advantages of the present invention will become apparent and obvious from a study of the following description and the accompanying drawings which are merely illustrative of the present invention.

In the drawings:

FIG. 1 is a longitudinal, sectional view of a preferred embodiment of the continuous juice extractor of the present invention drawn in schematic form;

FIG. 2 is an end view taken from lines 2–2 of FIG. 1; and

FIG. 3 is a section taken through lines 3–3 of FIG. 1.

With further reference to the drawings, the extractor indicated generally at **10** is composed of a feed portion indicated generally at **11** and an extractor portion indicated generally at **12**. This last mentioned portion is composed of a rigid, generally cylindrical housing **13**.

A generally funnel-shaped bladder support **14** is fixedly secured to the interior of wall **13** adjacent the point where the feed portion **11** and extractor portion **12** are joined. This support inwardly projects from its circumventional mounting inwardly at an angle away from feed portion **11**.

A second bladder support **15** is circumventionally mounted about the interior of wall **13** at the end of the extractor portion opposite such portions' connection to the feed portion. This second support inwardly projects at an angle toward said first-mentioned support **14**.

Sealingly secured at one end to the interior portion of support **14** is a generally cylindrical-shaped flexible sleeve or bladder **16**. The other end of this sleeve or bladder is sealingly secured to the interiormost portion of support **15**. Thus it can be seen that a sealed, tubular-shaped air space is formed between the outer wall **13** and the bladder **16**.

A generally circular, supporting end cap **17** is attachingly secured to the end of wall **13** adjacent bladder support **15**. A bearing **18** is centrally disposed within end support **17** and is supported thereby through bearing brackets **19** and **19'**.

To the end of wall **13** opposite support **17** is fixedly secured circular support **20**. A matching support **21** is secured to support **20** and is adapted to be fixedly secured to the generally cylindrical-shaped wall **22** of feed portion **11**.

A hopper **23** is built into the end portion of wall **22** opposite support **21** so that the product to be processed may be fed into the interior of the extractor **10** as will hereinafter be described.

Centrally mounted on the partially closed end **24** of feed portion **11** is a circular bearing **25**.

An elongated hollow tube indicated generally at **26** is adapted to be centrally disposed and rotatively mounted within the extractor **10**. One end of this tube has fixedly secured thereto end block **27**. Outwardly projecting from block **27** is pin **28** which is rotatively supported by bearing **18**.

The wall of the portion of tube **26** which lies juxtaposed to bladder **16** is perforated particularly as seen in FIG. **1**. Spirally mounted about the exterior of the perforated portion **29** of tube **26** is screw feeder **30**. This feeder is generally semicylindrical in cross section so as not to damage the bladder **16** when it comes in contact with the same as will be hereinafter described.

The imperforate portion **31** of tube **26** which lies within feed portion **11** has a screw conveyor blade **32** spirally mounted to the exterior thereof as noted particularly in FIG. **1**.

Tube **26** extends out through the end **24** of the feeder portion **11** and is supported by circular bearing **25**. A series of outwardly projecting teeth **33** are circumventionally mounted about tube **26** exterior of extractor **10** and generally adjacent to bearing **24**. A chain drive **34** is adapted to operatively engage teeth **33** in such a manner that when motor **35** is rotated tube **26** will rotate.

The end of tube **26** opposite end cap **27** and outwardly from teeth **33** tapers to neck portion **36** which terminates in ball joint **37**.

Due to the construction of this ball joint a liquid impervious seal is formed between tube **26** and inlet pipe **38** of vacuum chamber **39**.

The upper portion of chamber **39** has an opening therein to which is communicatively attached vacuum line **40** which leads to a vacuum source (not shown). Also operatively mounted to the upper portion of vacuum chamber **39** is pressure guage **41**.

Communicatively and operatively connected to the lower portion of chamber **39** is a variable delivery pump **42** with an inlet line **43** and a discharge line **44**. This pump may be selectively regulated by control means (not shown).

Communicating between the exterior and interior of wall **13** is a pressure fluid line **45** which is operatively secured to a fluid pressure source (not shown) such as a pump. Also operatively connected to wall **13** is pressure gauge **46** for operation as will be hereinafter described.

OPERATION

In actual operation of the extractor of the present invention, the product from which liquid is to be removed is coarsely ground with a comminutor through a screen of predetermined size. It has been found through experimentation that for apples and similar products, a 0.25 inch screen is preferred. Approximately 2 pounds of filter aid such as rice hulls is mixed with each bushel of product. This filter aid improves the separation of the juice from the pulp solids and for this reason is desirable. Although only the product will hereinafter be referred to, it is understood that if a filter aid is mixed with the product such aid will follow the course of the product through the operation of the extractor.

The product is continuously fed into hopper **23** as indicated by the arrow in FIG. **1** and is picked up by conveyor blade **32** which rotates in a clockwise direction with tube **26** to move the product away from end **24** of feed portion **11** toward extractor portion **12**. Due to the angular taper of bladder support **14**, the product is smoothly fed into conveying contact with the spiral conveyor projections **30** on the perforate portion **29** of tube **26**. These conveyor projections move the product along between tube and the bladder toward the open end **48** of the extractor.

A fluid under a predetermined amount of pressure is introduced through inlet line **45** into the tubular-shaped opening or cavity **49** between bladder **16** and wall **13**. The pressure under which the fluid is maintained may readily be determined by referring to the reading on pressure gauge **46**. As will be obvious from FIG. **1**, as the fluid pressure is increased in the cavity **49**, the flexible bladder **16** will apply a squeezing pressure on the product passing between such bladder and the perforate portion **29** of tube **26**. Once the correct predetermined pressure is obtained in the bladder cavity for maximum liquid removal from the product being processed, the liquid within the product will be squeezed through the perforations in the tube to the interior thereof. As the product is squeezed in the area where the tube is juxtaposed to the bladder, such product will be reduced to a relatively dry pulp before it is extruded through the opening **51** of end **48**.

Although the gravity flow of the liquid inside the tube may be adequate in many cases, in other cases it may be preferred to have a secondary means for assisting the flow. To accomplish this, a vacuum chamber **39** may be attached through means such as the ball joint **37** to the rotating juice-containing tube. Subatmospheric pressure between 15 and 29 inches of mercury in the case of apples has been found adequate to not only assist in the sucking of the extracted juice from the tube but also to adequately deaerate the juice for better preservation of its taste and color. Once the speed of the motor **35** has been adjusted to the desired revolutions per minute for tube **26** and the input of product into the hopper **23** has been correctly adjusted to the capacity of the device, the variable delivery of pump **42** can be regulated to remove the liquid **50** within chamber **39** at the same rate at which it is entering through inlet **38** so that the entire extraction process can continue to operate for indefinite lengths of time with only minor adjustments from time to time possibly being necessary if there are variations in the liquid content of the product being processed.

Although the air pressure within the bladder cavity may range any where from 5 to 100 pounds p.s.i., it has been found that for products such as apples that a pressure of 10 pounds p.s.i. is adequate. This pressure, of course, would vary as the percentage of liquid within the product varies as well as any changes in the size of the comminutor screen.

Although the comminutor has been mentioned for grinding the product prior to its being processed through the extractor, some products such as grapes are preferably crushed. If desired, the extractor obviously could be used without crushing or commutating the product prior to its introduction into hopper **23**.

It is obvious that the present invention has the advantage of being simple to construct and maintain and yet is extremely efficient in the removal of liquids from the product being processed in a continuous feed operation. The present invention also has the advantage of allowing the extracted liquid to be removed from the extractor and deaerated in a single-step process thus adding even greater economy to the already economical system.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive and all changes coming within the equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. The process of removing the liquid from a liquid-bearing product comprising: feeding the product into a screw-type conveyor; applying fluid pressure to a bladder circumventionally disposed about said conveyor; removing the liquid forced by the squeezing action from the product through openings in the walls of said conveyor to the center thereof; and discharging said squeezed product from said extractor by continuous rotation of said conveyor.

2. The process of claim **1** including: applying a vacuum to the center of said conveyor to remove and deaerate the liquid contained therein.