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 [21] Appl. No. **72,281**
 [22] Filed **Sept. 15, 1970**
 [45] Patented **Nov. 30, 1971**
Original application Jan. 29, 1968, Ser. No. 701,173, now Patent No. 3,550,526.
Divided and this application Sept. 15, 1970, Ser. No. 72,281

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

[52] U.S. Cl. 100/117,
 100/211
 [51] Int. Cl. B30b 5/02
 [50] Field of Search 100/211,
 212, 90, 117, 116, 37, 122, 126, 165; 146/236;
 18/12 SJ

[56]

References Cited**UNITED STATES PATENTS**

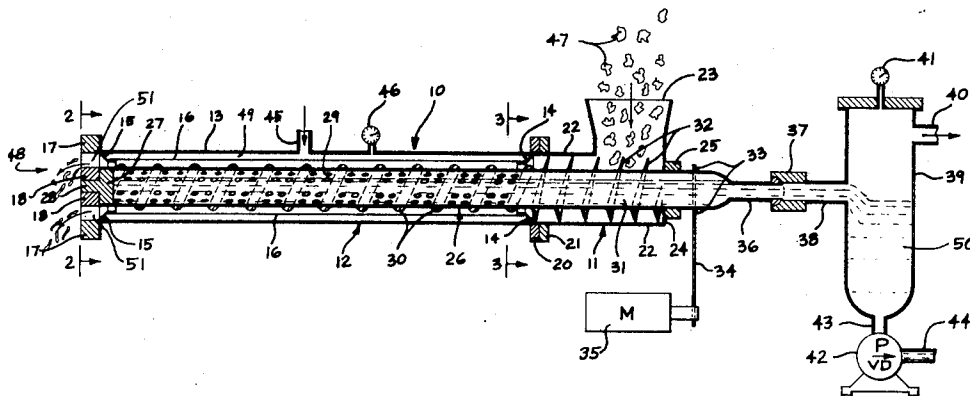
2,593,292	4/1952	Gaugler.....	100/211 X
2,640,342	6/1953	Rand	100/37
2,848,939	8/1958	Warner	100/211 X
3,269,157	8/1966	Ashley.....	100/211 X

FOREIGN PATENTS

515,135	2/1955	Italy	100/211
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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.



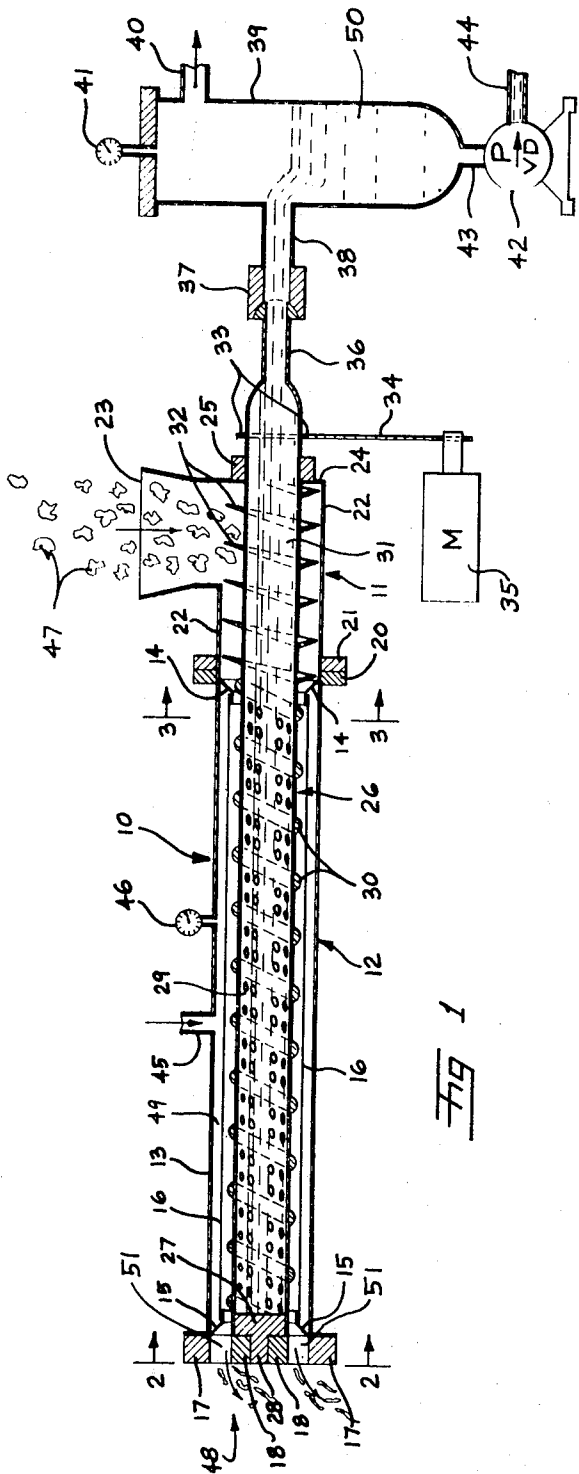


FIG 1

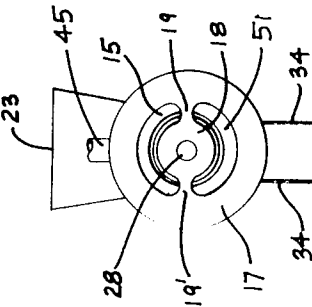


FIG 2

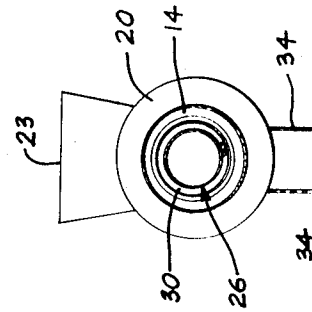


FIG 3

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CONTINUOUS JUICE EXTRACTOR

This is a division of application, Ser. No. 701,173, filed Jan. 29, 1968, now U.S. Pat. No. 3,550,526.

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 interior most 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 screwfeeder 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 gauge 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 comminuter 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 con-

tinue 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 anywhere from 5 to 100 pounds per square inch, it has been found that for products such as apples that a pressure of 10 pounds per square inch 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 comminuter screen.

Although the comminuter 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 comminuting 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.

What is claimed is:

1. In a juice extractor including a hollow core screw-type conveyor having a perforate wall portion along at least a portion of its longitudinal length, the improvement comprising: a flexible sleeve disposed about said conveyor juxtaposed to said perforate portion; and means for pressing said bladder toward said conveyor whereby the liquid within a liquid bearing product may be squeezed from such product.

2. The extractor of claim 1 wherein the pressure means is a fluid pumped under pressure into an opening inside said sleeve.

3. A juice extractor comprising: a generally cylindrical housing; a rotatable tube centrally disposed within said housing, the wall along a portion of the length of said tube being perforate; at least one conveyor blade spirally attached to the exterior of said tube; a flexible bladder attached to the interior of said housing juxtaposed to the perforate portion of said tube, the area between said bladder and said housing forming a fluidtight cavity; means to maintain a fluid under pressure within said cavity; and means to rotate said tube relative to said housing whereby a liquid bearing product may be squeezed between said bladder and said perforate portion as such product is conveyed through the extractor by said conveyor blade.

4. The extractor of claim 3 including a vacuum chamber operatively connected to one end of said tube, and means for producing subatmospheric pressure within said chamber whereby liquid passing into such tube through the perforate wall portion thereof may be deaerated and removed.

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