Title: JUICE EXTRACTION DEVICES WITH HOLLOW JUICE EXTRACTION SCREW

Abstract: Juice extraction device is provided for extracting juice from food including a hollow juice extraction screw capable of being rotated along an axis and having a food inlet through which said food enters the juice extraction device; a mesh filter for separating the juice from the food, said mesh filter unit encompassing the juice extraction screw; and a housing encompassing the mesh filter. The provision of a hollow juice extraction screw can minimize the length of the device while maintaining juicing efficiency. This also allows such devices to be placed vertically, such that additional advantages can be provided by placing various components including juice exit at the bottom position.
Juice Extraction Devices with Hollow Juice Extraction Screw

Field of the Invention

This invention relates to juice extraction device for extracting juice from food, particularly those operate at about 40-300 rounds per minute, or so called "slow juicers", more particularly so called "vertical masticating juicers".

Background of the Invention

Juice extraction device is a kind of home appliance for extracting juice from food, such as fruit, herbs, leafy greens, vegetable and the like. Currently there are three types of commercial juice extraction devices, namely, (1) centrifugal juicers run at high speed typically above 10,000 RPM; (2) masticating juicers and (3) triturating juicers both types known as slow juicers operated at relatively slow speed in the region of lower hundreds RPM. It is believed that low speed juicing process could avoid oxidation, which could damage or destroy enzymes contained in juice, and thus it is believed that low speed juicing could preserve nutrition and flavor of juice. Masticating juicers use a profiled screw style molding to compact and crush fruit and vegetable matters against meshes, allowing juice to flow through the meshes while filtering the fruit and vegetable. The current invention is directed to such masticating juicers.

Masticating juicers can be broadly classified to two major variants based on the mechanical alignment of the profiled screw. These two variants are: (1) the horizontal variant where the profiled screw is aligned horizontally and (2) the vertical variant where the profiled screw is aligned vertically. The horizontal profiled screw typically is a helical screw in cylindrical shape whereas the vertical profiled screw is a slanted conical helix screw with an extended cutter blade at the top tip end. There is one common feature that all commercial available vertical masticating juicers exhibits - food enters at a first position and the extracted juice and food residue separately discharge at another second position, where the first position is higher than the second position. The two discharge points, for the juice and the residue, are generally roughly at the same elevation. The residue is often still juicy with substantial juice contents.

It is desirable to provide a juice extraction device having improved juice extraction efficiency with relatively low manufacturing complexity.
Objects of the Invention

An object of this invention is to provide a juice extraction device with improved juice extraction efficiency and/or with relatively low manufacturing complexity compared to the same type of the juice extraction devices of the prior art.

Summary of the Invention

Accordingly, this invention provides a juice extraction device for extracting juice from food which includes:

- a hollow juice extraction screw capable of being rotated along an axis and having a food inlet through which said food enters the juice extraction device;
  - a mesh filter for separating the juice from the food, said mesh filter unit encompassing the hollow juice extraction screw; and
  - a housing encompassing the mesh filter.

The food inlet may be unified with the hollow juice extraction screw, or alternatively, the food inlet can be a separate part from the hollow juice extraction screw.

Food may enter the food inlet from a first end and exits from a second end opposing said first end along a first direction, after which said food is moved along the mesh filter along a second direction opposing said first direction. Additionally, the juice extraction device further includes a food recycling conduit positioned in proximity to said first end for allowing the food to re-enter said food inlet. The juice extraction device may further include a residue exit for allowing residue to exit from the juice extraction device and connecting to the food recycling conduit, and a switch for closing at least one of the residue exit and the food recycling conduit.

The first end may be positioned upward from the second end such that said axis is vertical.

The juice extraction may further include a juice exit for allowing juice to exit from the juice extraction device, wherein the juice exit is positioned in proximity to said second end. Additionally, the mesh filter has a unified mesh filter bottom at the second end.

The food inlet may further include at least one blade at said second end. Additionally, at least a portion of said blade can be made of metal for cutting the food.
The above summary does not provide an exhaustive list of inventive concepts. Other inventive concepts may be present from different features or elements or different combinations of features or element described herein. In particular, the above optional features or elements can be incorporated into any technical solutions of the current invention in any combinations desired.

**Brief description of the drawings**

Preferred embodiments of the present invention will now be explained by way of example and with reference to the accompanying drawings in which:

**Figure 1** shows an exploded view of an exemplary juice extraction device of the present invention;

**Figure 2** shows a further exploded view of the juice extraction device of **Figure 1** with the exploded view of the juice extraction mechanism;

**Figure 3** shows another exploded view of the juice extraction device of **Figure 2**;

**Figure 4** shows a cross sectional view of the juice extraction device along the lines A-A’ in **Figure 3**;

**Figures 5A & 5B** show cross sectional view of the juice extraction mechanism with the opening and closing of the switch related to the food recycling exit and the residue exit; and

**Figures 6A & 6B** shows partial cutaway views of the juice extraction mechanism with the opening and closing of the switch related to the food recycling exit and the residue exit without showing the push rod.

**Detailed Description of the Preferred Embodiment**

This invention is now described by way of examples with reference to the figures in the following paragraphs. Objects, features, and aspects of the present invention are disclosed in or are apparent from the following description. It is to be understood by one of ordinary skilled in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions. **List 1** is a list showing the parts and respective reference numerals in the figures.

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<thead>
<tr>
<th>Reference numeral</th>
<th>Part name</th>
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<tbody>
<tr>
<td>100</td>
<td>Juice extraction device</td>
</tr>
<tr>
<td>200</td>
<td>Housing</td>
</tr>
<tr>
<td>202</td>
<td>Juice exit</td>
</tr>
<tr>
<td>204</td>
<td>Residue exit</td>
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</tbody>
</table>
List 1

An exemplary juice extraction device 100 of this invention is shown in Figures 1 and 2. The juice extraction device 100 has juice extraction mechanism 300 for extracting juice from food encompassed by a housing 200. The housing 200 has a juice exit 202 from which juice extracted from the food exits, and a residue exit 204 from which remnant remaining after juice extraction exits. Details of the juice extraction mechanism 300 will be described below. An optional push rod 400 is shown, and is used to push food into the juice extraction mechanism 300. At the bottom of the housing 200, an optional driver housing 500 housing the driver 506 (shown in Figure 4) is provided, which can also be used to provide support to the housing 200 on a flat surface, like table top. The driver 506 is optional and the juice extraction device 100 can be driven by hand if desired. Optional juice container 502 for holding juice exists from the juice exit 202, and optional residue container 504 for holding residue exits from the residue exit 204 are also shown in Figure 1.

Further exploded views of the juice extraction mechanism 300 are shown in Figures 2 and 3. In this particular embodiment shown in Figures 2 and 3, the juice extraction mechanism 300 has a mesh filter 302 encompassing a hollow juice extraction screw 310. The mesh filter 302 is responsible for separating the juice from the food. The hollow juice extraction screw 310 is capable of being rotated by the driver 506 connected thereto along the axis Z, and has a food inlet 320 through which food enters the juice extraction device 300, more specifically to reach the mesh filter 302, for which the entrance can be assisted by the optional push rod 400. The food inlet 320 is shown and preferred to be a separate part from the hollow juice extraction screw 300 in this particular embodiment. However, the food inlet 320 can be unified with the juice extraction screw 310, but is less preferred as a unified food inlet 320 would have to rotate with the hollow juice extraction screw 300, thus extra load is added to the driver 506 that may reduce juicing efficiency.

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<tbody>
<tr>
<td>300</td>
<td>Juice extraction mechanism</td>
</tr>
<tr>
<td>302</td>
<td>Mesh filter</td>
</tr>
<tr>
<td>304</td>
<td>Mesh filter bottom</td>
</tr>
<tr>
<td>306</td>
<td>Mesh filter alignment hole</td>
</tr>
<tr>
<td>310</td>
<td>Hollow juice extraction screw</td>
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<tr>
<td>312</td>
<td>Blade</td>
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<tr>
<td>314</td>
<td>Hollow juice extraction screw driver connector</td>
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<tr>
<td>320</td>
<td>Food inlet</td>
</tr>
<tr>
<td>322</td>
<td>Switch</td>
</tr>
<tr>
<td>324</td>
<td>Food recycling conduit</td>
</tr>
<tr>
<td>400</td>
<td>Push rod</td>
</tr>
<tr>
<td>500</td>
<td>Driver housing</td>
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<tr>
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Although it is preferred that the juice extraction screw 310 is in general cylindrical shape due to simplicity, it is not necessarily so and other shapes can be used, such as wedge shape, as long as it is hollow. Naturally, if the juice extraction screw 310 is of shape different from cylindrical shape, the shapes of the housing 200, the mesh filter 302 and food inlet 320 have to be adjusted accordingly.

In Figure 4, more details of various components of the juice extraction device 100 are shown by the cross sectional view along the lines A-A’ in Figure 3. It can be seen that the mesh filter 302 has a mesh filter bottom 304 with spiral protrusions or grooves, for which the protrusions or grooves, as know in the art, are used to "guide" food to move during the juice extraction process when the hollow juice extraction screw 310 rotates. The mesh filter bottom 304 may be unified or integrally formed with the mesh filter 302. To provide more available juice extraction area from the mesh filter 302, the mesh filter bottom 304 is provided at the bottom of this preferred embodiment. This is also the end where the juice exit 202 is placed. The mesh filter 302 also has a mesh filter alignment hole 306 through which the hollow juice extraction screw 310 connects the driver 506 via a hollow juice extraction screw driver connector 314.

In Figure 4, the hollow juice extraction screw 310 is shown to have an optional blade 312 at the bottom at the bottom, that is, the end where the juice extraction 202 is placed so as to reduce the total length of the juice extraction mechanism while maintaining the juice extraction efficiency. Placing the blade 312 at the bottom can give extra safety distance to the users in comparison to placing the cutting blade at the top without increasing the overall length of the juice extraction mechanism 300. This can allow the option to use metal blades, which can cut food more efficiently and effectively. In comparison, plastic blade is generally used by currently available vertical masticating juicers due to safety considerations without extending the length of the path of food entrance, that is the length of the hollow juice extraction screw 310, and therefore the height of the juice extraction device 100.

The operation of the juice extraction process is explained below. Food enters the juice extraction device 100 through food inlet 320 at the top or the first end, and exits from the bottom or the second end in Figures 1, 2, and 4. The second end opposes the first end along a first direction, that is, from the top to the bottom in Figures 1, 2, and 4. The food is cut by the blade 312 if such is available, and then reaches at the mesh filter bottom 304. As the hollow juice extraction screw 310 rotates, food is moved along the mesh filter in a second direction opposing the first direction, that is, upwards in Figures 1, 2, and 4. During the
process, juice is extracted or separated from the food. The juice extraction device is preferred to be vertically placed, that is, the hollow juice extraction screw 310 has a vertical axis of rotation.

The juice exit 202, the mesh filter bottom 304 and the blade 312 are all positioned in proximity to the bottom, that is the second end, of the juice extraction device 100 in Figure 4. For the juice exit 202, such placement at bottom may allow collection of more juice due to gravity. For the mesh filter bottom 304 and the blade 312, such placements can reduce the overall length and therefore the size of the juice extraction device 100 due to reasons explained above.

Such vertical placement of the juice extraction device 100 also allows an additional advantageous feature of the current invention. Specifically, such vertical placement allows the optional provision of a food recycling conduit 324 to be placed in proximity to the top, that is the first end, of the juice extraction device 100. This is preferred such that food can be recycled relatively easily by movement due to gravity. To control the recycling, the food recycling conduit 324 is connected to the residue exit 204, and a switch 322 is further provided to close at least one of the residue exit and the food recycling conduit. In Figures 5A and 6A, the switch 322 is opened to the residue exit 204 such that residue can exit from the residue exit 204 without recycling. In Figures 5B and 6B, the switch 322 is opened to the food recycling conduit 324 such that food can re-enter the food inlet 320 for recycling. When the switch 322 is opened to the food recycling conduit 324, closed-loop juice extraction can be achieved. The juice extraction device 100 makes use of the volumetric displacement feature of the hollow juice extraction screw 310 and relatively simple re-alignment of the mechanical configuration to achieve residue recycling capability.

While the preferred embodiment of the present invention has been described in detail by the examples, it is apparent that modifications and adaptations of the present invention will occur to those skilled in the art. Furthermore, the embodiments of the present invention shall not be interpreted to be restricted by the examples or figures only. It is to be expressly understood, however, that such modifications and adaptations are within the scope of the present invention, as set forth in the following claims. For instance, features illustrated or described as part of one embodiment can be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention cover such modifications and variations as come within the scope of the claims and their equivalents.
CLAIMS:

1. A juice extraction device for extracting juice from food, including:
   • a hollow juice extraction screw capable of being rotated along an axis and having a food inlet, said food enters the juice extraction device through the food inlet and the hollow juice extraction screw;
   • a mesh filter for separating the juice from the food, said mesh filter unit encompassing the hollow juice extraction screw; and
   • a housing encompassing the mesh filter.

2. The juice extraction device of claim 1, wherein said food inlet is unified with the hollow juice extraction screw.

3. The juice extraction device of claim 1, wherein said food inlet is a separate part from the hollow juice extraction screw.

4. The juice extraction device of claim 1 or 2, wherein said food enters the food inlet from a first end and exits from a second end opposing said first end along a first direction, after which said food is moved along the mesh filter along a second direction opposing said first direction.

5. The juice extraction device of claim 4 further including a food recycling conduit positioned in proximity to said first end for allowing the food to re-enter said food inlet.

6. The juice extraction device of claim 5 further including a residue exit for allowing residue to exit from the juice extraction device and connecting to the food recycling conduit, and a switch for closing at least one of the residue exit and the food recycling conduit.

7. The juice extraction device of any one of claims 4 to 6, wherein the first end is positioned upward from the second end such that said axis is vertical.

8. The juice extraction device of any one of claims 4 to 7 further including a juice exit for allowing juice to exit from the juice extraction device, wherein the juice exit is positioned in proximity to said second end.

9. The juice extraction device of claim 8, wherein the mesh filter has a unified mesh filter bottom at the second end.

10. The juice extraction device of any one of claims 4 to 7, wherein the food inlet further includes at least one blade at said second end.

11. The juice extraction device of claim 10, wherein at least a portion of said blade is made of metal for cutting the food.
Figure 1
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

A47J 19/02 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47J; A23N; A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; VEN; CNKI: extractor, extractor????, thread????, hollow, cavity, screw?, mesh, screen???, filter, filter

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C. ✅ See patent family annex.

* Special categories of cited documents:
  * "A": document defining the general state of the art which is not considered to be of particular relevance
  * "E": earlier application or patent but published on or after the international filing date
  * "L": document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  * "O": document referring to an oral disclosure, use, exhibition or other means
  * "P": document published prior to the international filing date but later than the priority date claimed
  * "R": later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  * "X": document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  * "Y": document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  * "&": document member of the same patent family

Date of the actual completion of the international search: 07 January 2015
Date of mailing of the international search report: 16 January 2015

Name and mailing address of the ISA/CN

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