



ПАТЕНТНО ВЕДОМСТВО НА РЕПУБЛИКА БЪЛГАРИЯ

ДОКЛАД ОТ ПРОУЧВАНЕ

ПРОУЧВАНЕ ВХ. № СпИС-820/26.07.2023 г. „Автоматизирана каскадна слънчева мултинагревателна инсталация с термопомпи за нискотемпературна обработка на хранителни продукти в камера с подналягане”

I. Уточнен класификационен индекс по МПК

F26B3/00; F26B21/00; F26B23/10; F26B3/28; H02S40/32; H02S40/34;

II. ОБЛАСТ НА ПРОУЧВАНЕ:

Минимален обхват на проучване

Вид класификация:

МПК

Класификационен индекс:

F26B3/00; F26B21/00; F26B23/10; F26B3/28;
H02S40/32; H02S40/34;

Бази данни, в които е извършено проучването

IPAS; Esp@cenet; Epoque Net, Internet

III. Релевантни документи

Категория	Цитиране на документите с посочване на релевантните части	Релевантни претенции
A	CN104011490 (A) публикуван на 27.08.2014 г. COUNCIL SCIENT IND RES	1-5
A	KR102045803(B1) публикуван на 18.11.2019 г. GREEN FARM CO LTD [KR]	1-5
A	PL237403 (B1) публикуван на 19.04.2021 г. PRZEMYSLOWY INSTYTUT MASZ ROLNICZYCH [PL]	1-5
A	BG111811 (A) публикуван на 29.02.2016 г. GATEB ГАТЪО [BG]; ЯНКОВ ВАЛЕРИ [BG]	1-5
A	US4882851 (A) публикуван на 28.11.1989 г. FITZPATRICK CO [US]	1-5

Категория на документа

X – документът е от особено значение;
претендираното изобретение няма новост или
изобретателска стъпка, когато документът се
разглежда самостоятелно

Y – документът е от особено значение;
претендираното изобретение няма
изобретателска стъпка, когато документът се
комбинира с един или повече други документи
и тази комбинация е очевидна за специалист в
областта

A – документ, отразяващ нивото на техниката,
който не е от особено значение

D – документ, цитиран в описанието

O – неписмено разкриване, използване, прилагане,
докладване или демонстриране

P – документ, публикуван преди датата на
подаване в България, но след приоритетната дата

E – по-рано подадена българска заявка, но
публикувана на или след датата на подаване

L – документ, който може да предизвика съмнение
относно приоритета на претенциите или който е
цитиран с цел установяване датата на публикация
на друг документ или друга специална причина
(както е посочено)

& - документ от една патентна фамилия

Дата: 04.08.2023 г.

Име: Десислава Иванова

Десислава Иванова
Старши експерт ДЕЗИПМПД

СТАНОВИЩЕ

ОТНОСНО: проучване за новост „Автоматизирана каскадна слънчева мултинагревателна инсталация с термopомпи за нискотемпературна обработка на хранителни продукти в камера с подналягане”

Спис – 820/26.07.2023 г.

Към искането за проучване са приложени описание, претенции и чертеж.

Формулирани са една независима патентна претенция и четири зависими патентни претенции.

Съгласно патентни претенции от 1 до 5 проучването се отнася до автоматизирана каскадна слънчева мултинагревателна инсталация с термopомпи за нискотемпературна обработка на хранителни продукти в камера с подналягане, включваща херметична камера, тръбно свързана през програмируем студен клапан с вакуумна помпа. В херметичната камера са монтирани резисторен нагревател, който през резисторно изпълнително устройство е свързан с резисторен извод от електросилов разпределителен блок. Индуктивен нагревател през индукционно изпълнително устройство е свързан с индукционен извод от електросилов разпределителен блок. Инфрачервен нагревател през инфрачервено изпълнително устройство е свързан с инфрачервен извод от електросилов разпределителен блок. Термopомпен агрегат през термopомпено изпълнително устройство е свързан с термopомпен извод от електросилов разпределителен блок. Вакуумната помпа през вакуумно изпълнително устройство е свързана с вакуумен извод от електросилов разпределителен блок. При което първи управленски извод от централен оптимизационен блок е свързан с управленски вход на резисторното изпълнително устройство, втори управленски извод от централния оптимизационен блок е свързан с управленски вход на индукционно изпълнително устройство, трети управленски извод от централния оптимизационен блок е свързан с управленски вход на инфрачервеното изпълнително устройство, четвърти управленски вход от централния оптимизационен блок е свързан с управленски вход на вакуумно изпълнително устройство. Първи сигнален вход на централен оптимизационен блок е безжично свързан с изход от датчик за температура на въздуха в херметичната камера, втори сигнален вход на централния оптимизационен блок е безжично свързан с изход от датчик за влажност на въздуха в херметичната камера и трети сигнален вход на централния оптимизационен блок е безжично свързан с изход от датчик за разреждане на въздуха в херметичната камера. Топлинен вход от външен първи правоъгълен слънцеприемник е тръбно свързан с топлообменник в херметичната камера. Електрически вход от втори външен слънцеприемник през програмируем външен фотоволтаичен контролер е свързан с първи електросилов вход на електросиловия разпределителен блок, чиито втори електросилов вход е свързан с извод от електрическа мрежа, като към долния ръб на първия външен правоъгълен слънцеприемник е монтиран долния ръб на външен плосък правоъгълен отразител.

Централният оптимизационен блок е програмируем.

Първият външен правоъгълен слънцеприемник е течнофлуиден.

Вторият външен правоъгълен слънцеприемник е фотоволтаичен.

Термopомпения агрегат е сплит система въздух- въздух.

Задача на изобретението е да се обезпечи автоматизирана каскадна слънчева мултинагревателна инсталация с термopомпи за нискотемпературна обработка на хранителни продукти в камера с подналягане, която да работи енергоикономично със слънчева енергия от светоусилени слънцеприемници, в зависимост от същността на обработваните продукти и влагата в тях, чрез централен оптимизационен блок, програмиран с изкуствен интелект за управление на най-разнообразни технологични режими с възможност за самообучение на основание автоматичен анализ на собствената си работна история.

При извършеното проучване се установи наличие на известни от предшестващото състояние на техниката документи, отразяващи нивото на техниката, които са посочени в приложения доклад от проучване и които не са противопоставими по новост на обекта на проучване, а именно:

- **CN104011490 (A)** публикуван на **27.08.2014 г.**, който разкрива подобрена слънчева сушилня с повишена ефективност на сушене, състояща се от слънчев абсорбатор/колектор и сушилна камера. Единият край на колектора е свързан към нагнетателен вентилатор, а другият край е свързан с сушилната камера. Сушилната камера има чекмедже, в което върху телена мрежа се съхранява сушеният материал. Освен това сушилнята разполага с възможност за поставяне на цветен индикативен силикагел под телената мрежа, когато работи в режим на рециркулация. Другият край на сушилната камера има вентилатор с индуцирана тяга. И двата вентилатора за постоянен ток работят с фотоволтаичен панел от 10 вата. V-образни рефлексори от анодизиран алуминий са фиксирани върху колектора и по избор върху сушилната камера. Вградена е верига за проследяване за автоматично проследяване на сушилнята. Закljučващ механизъм също е включен, за да помогне на устройството да издържи на силно натоварване от вятър. Освен това сушилнята има възможност за програмируема рециркулация на отработения въздух от сушилната камера, след като влажността му падне под предварително зададена стойност, който процес помага да се ускори скоростта на сушене.
- **KR102045803(B1)** публикуван на **18.11.2019 г.**, който разкрива нискотемпературна сушилня, използваща слънчева топлина и геотермална топлина, която е икономична и екологична, чрез въвеждане и циркулация на топъл горещ въздух във вътрешната долна част на сушилнята, като по този начин позволява високоефективно сушене на културите. Хоризонтален шнек е разположен вътре в нискотемпературната сушилня и върху радиалната външна повърхност на въртящ се вал на хоризонталния шнек, множество крила за прехвърляне на селскостопански продукти в странична посока в контакт със селскостопански продукти, които множество крила са спираловидно оформени чрез изпъкване и хоризонталният шнек се задвижва ротационно от задвижващ двигател, а устройство за генериране на слънчева енергия е монтирано на покрива на нискотемпературната сушилня. Стъклена плоча е монтирана върху горната повърхност на батерийния модул и първи път на въздушния поток P1 е определен

между вътрешната горна повърхност на основното тяло и горната водеща плоча за циркулация на външния въздух, докато се затопля от слънчева топлина и между вътрешната долна повърхност на тялото и долната направляваща плоча.

- **PL237403 (B1) публикуван на 19.04.2021 г.**, който разкрива хибридна PV/T система за сушене на растителна биомаса, включваща компоненти като PV/T система, напречен радиален вентилатор, електрически нагревател, концентратор на слънчева радиация с параболична форма, термично изолирана дюза и камерна сушилка. PV / T системата е със структура във формата на правоъгълно твърдо тяло, в което хоризонталните успоредни стени представляват батерия от фотоволтаични клетки отгоре и прозрачна пластмаса отдолу. Между успоредните стени има алуминиева плоча – абсорбер, която разделя полученото пространство на два независими канала. Абсорбаторът от страната на батерията на фотоволтаичните клетки е покрит със слой изолационен материал, а откъм прозрачния материал страна със слой от материал, абсорбиращ слънчевата радиация. Изграждат се страничните, перпендикулярни стени на конструкцията с по-дългата страна. На една от перпендикулярните стени на конструкцията с по-къса страна е монтиран напречен радиален вентилатор с постоянноходен двигател. На противоположната, неразвита перпендикулярна стена с по-къса страна е монтиран електрически нагревател. Това е мястото, където се намира изходът от PV / T системата. Концентраторът на слънчева радиация с параболична форма е изработен от пластмаса, като горният му слой е покрит с материал с висок коефициент на албедо. Концентраторът е разположен отдолу и ръбовете му излизат извън общата ширина на PV / T системата. Батерия от силициеви фотоволтаични клетки е насочена към слънчевия диск и директно изложена на слънчева радиация. На повърхността на абсорбера радиацията се отразява от огледалното покритие на параболичния концентратор, прониквайки в прозрачната пластмаса. Хибридната PV/T система за изсушаване на растителна биомаса е оборудвана с електрическа система, в която електричеството, получено от батерия силициеви фотоволтаични клетки се съхраняват в тавата. Между батерията и тавата има регулатор на заряда. Нагревателят и електродвигателят на вентилатора са свързани към регулатора.
- **BG111811 (A) публикуван на 29.02.2016 г.**, който разкрива метод и устройство-сушилка за напълно автономно сушене с принудителна вентилация на продуктите, със слънчева енергия, при което вентилатор, захранван от фотоволтаичен панел, засмуква въздух от околната среда и създава принудителна непрекъснат въздушен поток, който преминава през въздушен слънчев колектор, така че въздухът се нагрява, след което преминава през отворена сушилна камера, в която се поставят продуктите за сушене. В сушилната камера е поставен датчик за температура и влага, чиито сигнали се подават към контролер, който управлява въздушния поток, за да може да се поддържа относително постоянна температура на сушене.

- **US4882851 (A) публикуван на 28.11.1989 г.**, който разкрива апаратура и метод за периодично сушене с помощта на микровълнова вакуумна система, като апаратурата за партидно сушене на прахообразен или специален продукт с микровълнова вакуумна система е разкрит заедно с метод за контролиране на процеса на сушене. Апаратурата включва камера за сушене на продукта. Продуктът се намира във вътрешен контейнер за продукта. Контейнерът за продукта и камерата са координирани, за да позволят лесно отваряне на релсова система. Апаратурата включва още и средство за предизвикване на вакуум в камерата, което може също така да изтегли парите на разтворителя от камерата. Осигурен е източник на микровълни за камерата, а контейнерът за продукта има механизъм за разбъркване на продукта. Също така е разкрито средство за контролиране на операцията по сушене която позволява поддържане на избираеми параметри по време на операцията по сушене.

НОВОСТ

В нито един от намерените при проучването документи не е разкрито техническо решение автоматизирана каскадна слънчева мултинагревателна инсталация с термопомпи за нискотемпературна обработка на хранителни продукти в камера с подналягане, което да съдържа всички технически признаци на обекта на проучването.

Експертизата счита, че обектът на проучването **отговаря на изискванията за новост, съгласно чл. 8 от Закона за патентите и регистрацията на полезните модели (ЗПРПМ).**

Десислава Иванова
Старши експерт ДЕЗИПМПД



Espacenet

CN104011490A AN IMPROVED SOLAR DRYER WITH ENHANCED EFFICIENCY OF DRYING

Applicants: COUNCIL SCIENT IND RES

Inventors: GHOSH PUSHPITO KUMAR, MAITI SUBARNA, PATEL PANKAJ ARVIND BHAI, BHARADIA JITENDRA NARSINHBHAI, CHAUHAN SHOBHIT SINGH, SANGHANI MAHESH LAXMANBHAI, PARMAR PRADIP VINUBHAI, ESWARAN KRUTHIKA, AGRAVAT PARASKUMAR VIVEKBABU

Classifications:

IPC **F26B21/04; F26B21/08; F26B3/28;**

CPC **F24S10/50 (EP,US); F24S20/25 (EP,US); F24S23/77 (EP,US); F24S30/422 (EP,US); F26B21/04 (EP,US); F26B21/083 (EP,US); F26B3/28 (US); F26B3/286 (EP,US); Y02B40/18 (EP,US); Y02E10/40 (US); Y02E10/44 (EP,US); Y02E10/47 (EP,US);**

Priorities: IB2011001039W 2011-05-16

Application: CN201180071899A·2011-05-16

Publication: CN104011490A·2014-08-27

Published as: CN104011490A; **CN104011490B; US2014182158A1; WO2012156768A1**

AN IMPROVED SOLAR DRYER WITH ENHANCED EFFICIENCY OF DRYING

Abstract

The present invention provides an improved solar dryer with improved. The dryer consists of a solar absorber/collector (9) and a drying chamber (6). One end of the collector is connected to a forced draft fan (10) and the other end connects the drying chamber. The drying chamber has a drawer in which the material to be dried is kept on a wire mesh. The dryer further has the provision for placing color indicative silica gel under the wire mesh when operated in recirculation mode. The other end of the drying chamber has an induced draft fan (11). Both the dc fans operate using a 10 watt photovoltaic panel (3). V-trough reflectors (4,5,7,8) made from anodized aluminum are fixed on the collector and optionally on the drying chamber. A tracking circuit is incorporated to auto-track the dryer. A locking mechanism (14) is also incorporated to help the unit withstand high wind load. The dryer further has the provision of programmable recirculation of the spent air from drying chamber once its humidity drops below a pre-set value which process helps to speed up the rate of drying.

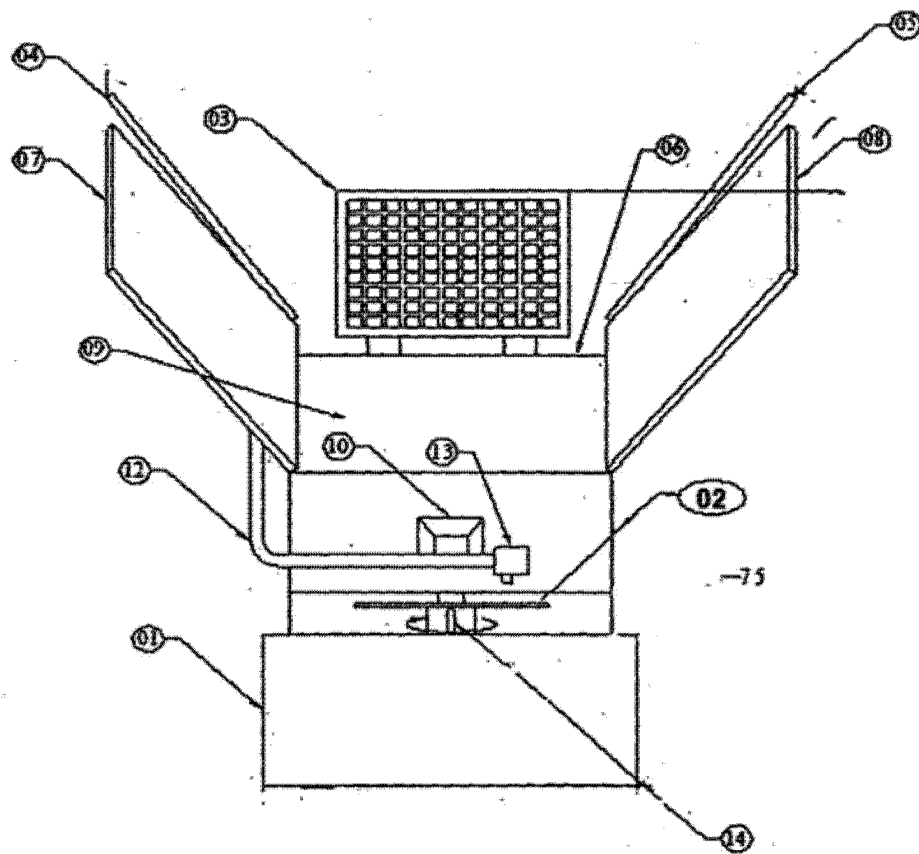


图 2

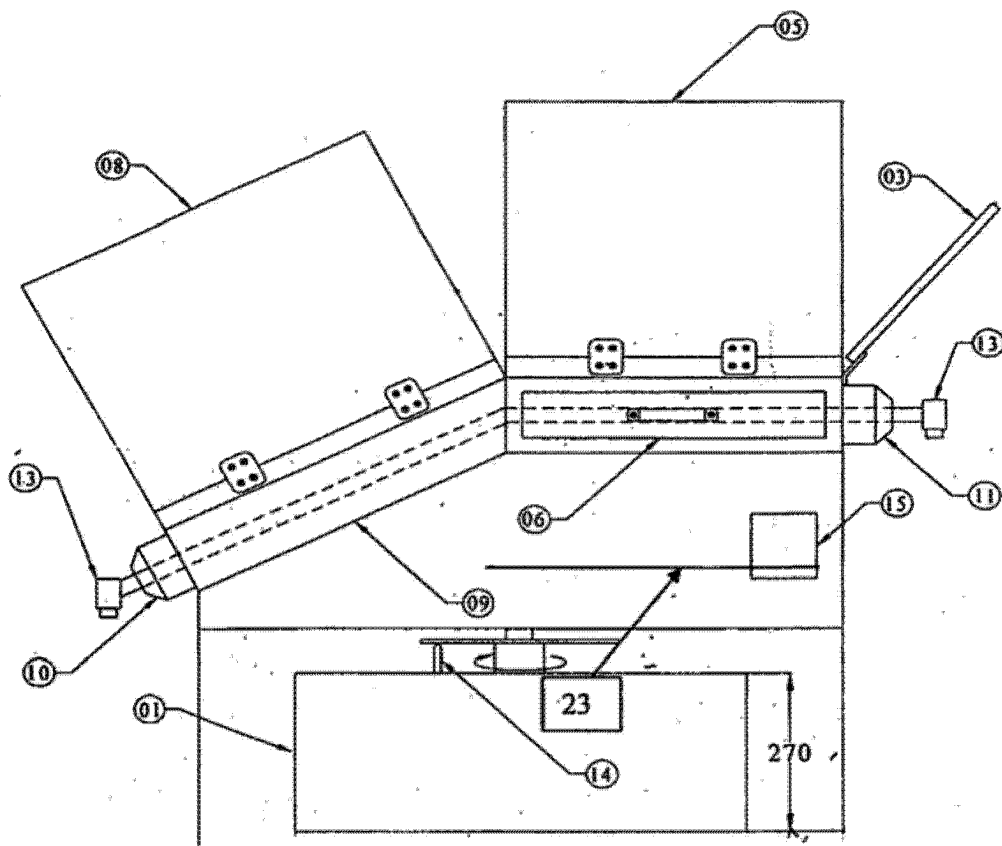


图 3



Espacenet

KR102045803B1 Low-temperature dryer utilizing solar energy and geothermal energy

Applicants: GREEN FARM CO LTD [KR]

Inventors: KIM YUN JEONG [KR]

Classifications:

IPC **A23B7/02; F26B21/00; F26B3/28; H02S40/32; H02S40/34; H02S40/38;**

CPC **A23B7/02 (KR); F26B21/002 (KR); F26B3/28 (KR); H02S40/32 (KR); H02S40/34 (KR); H02S40/38 (KR); Y02B10/10 (EP); Y02E10/50 (EP,KR); Y02E70/30 (EP); Y02P60/85 (EP);**

Priorities: KR20180034460A 2018-03-26

Application: KR20180034460A·2018-03-26

Publication: KR102045803B1·2019-11-18

Published as: KR102045803B1;**KR20190112448A**

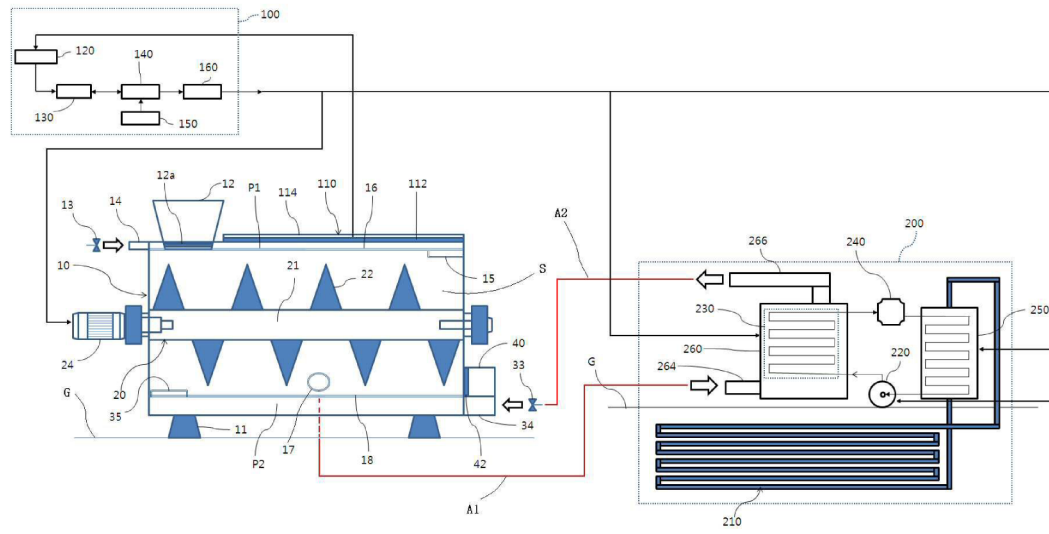
Low-temperature dryer utilizing solar energy and geothermal energy

Abstract

태양전지가 내장된 복층유리를 건조기의 지붕에 설치하고 그 아래로 외기를 도입하여 순환시킴과 동시에 지중에 매설된 열교환 파이프를 채운 지중 열교환기장치에 의해 10~35°C의 천부지열을 이용하여 데워진 더운 공기를 건조기의 내측 하부로 도입하여 순환시킴으로써, 농작물의 고효율 건조가 가능하여 경제적이고 친환경적인 태양열과 지열을 이용하는 저온 건조기가 개시된다. 저온 건조기의 내부에는 수평오거(20)가 배치되고, 상기 수평오거(20)의 회전축(21) 방사상 외면상에는 농산물과 접촉하여 농산물을 횡방향으로 이송하기 위한 다수의 날개들(22)이 나선형으로 돌출하여 형성되며, 상기 수평오거(20)는 구동모터(24)에 의해서 회전 구동되고, 저온 건조기의 지붕에는 태양광 발전장치(100)가 설치되는데, 복수의 태양전지(130)가 내장된 태양전지 모듈(110)의 상부면상에는 유리판(114)이 설치되며, 본체의 내측 상부면과 상부 가이드판(16) 사이에는 외기를 순환시키면서 태양열에 의해 가온하기 위한 제1 공기유로(P1)이 한정되고, 본체의 내측 하부면과 하부 가이드판(18) 사이에는 지열에 의해 가온된 공기를 순환시키기 위한 제2 공기유로(P2)이 한정되고, 지열에 의해 가열된 공기를 제2 공기유로(P2) 쪽으로 제공하기 위한 지중 열교환기장치(200)는 지중의 열을 효과적으로 얻을 수 있도록 지그재그 형태의 긴 관으로 이루어진 열교환 파이프(210)를 구비한다.

도면

도면1





Espacenet

PL237403B1 Hybrid PV/T system intended for plant biomass drying

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Classifications:

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Hybrid PV/T system intended for plant biomass drying

Abstract

Abstract not available for PL237403B1 – abstract of corresponding document: PL418978A1

Przedmiotem zgłoszenia jest hybrydowy układ PV/T przeznaczony do suszenia biomasy roślinnej, który to układ stanowi urządzenie składające się z elementów takich jak układ PV/T (1), poprzeczny wentylator promieniowy (2), grzałka elektryczna (3), koncentrator promieniowania słonecznego o kształcie parabolicznym (4), izolowana termicznie dysza (5) oraz suszarka komorowa (6). Urządzenie generuje strumień podgrzanego powietrza na wylocie z układu PV/T, które następnie wtłaczane jest za pośrednictwem dyszy (5) do suszarki komorowej (6). Przepływ powietrza wymuszony jest w sposób mechaniczny przez poprzeczny wentylator promieniowy (2) umiejscowiony na wlocie układu PV/T.

Rysunki

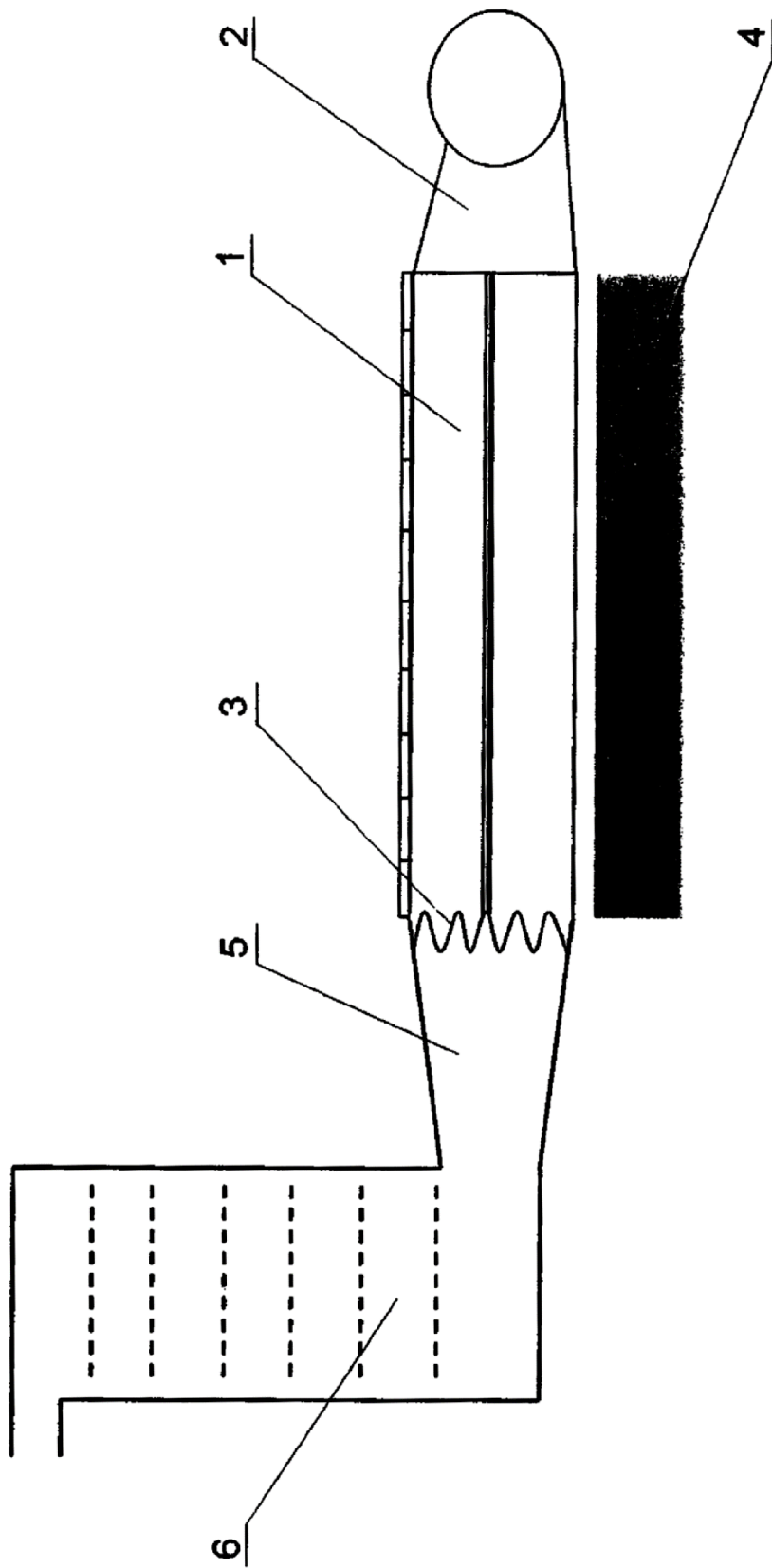


fig. 1

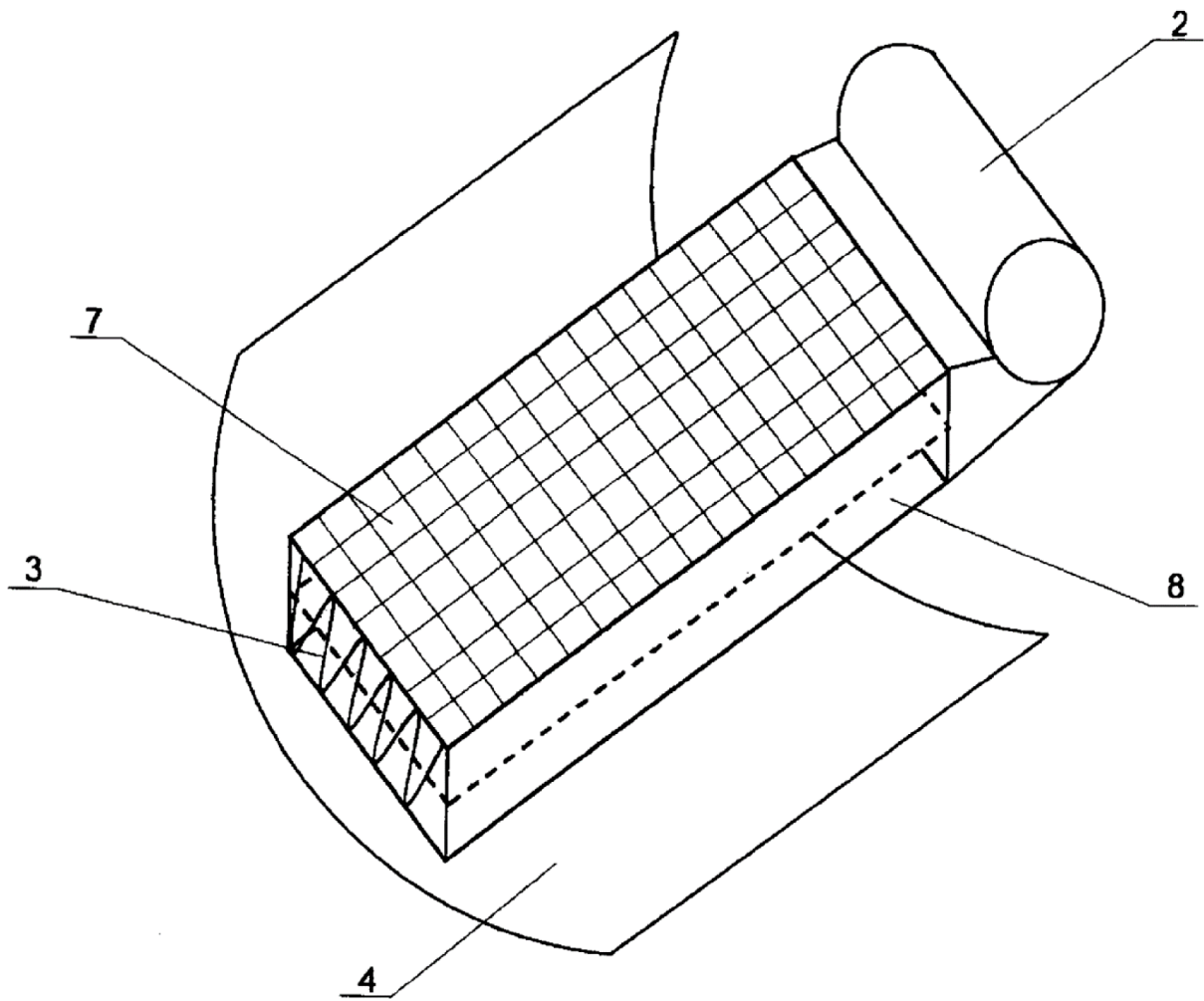


fig. 2

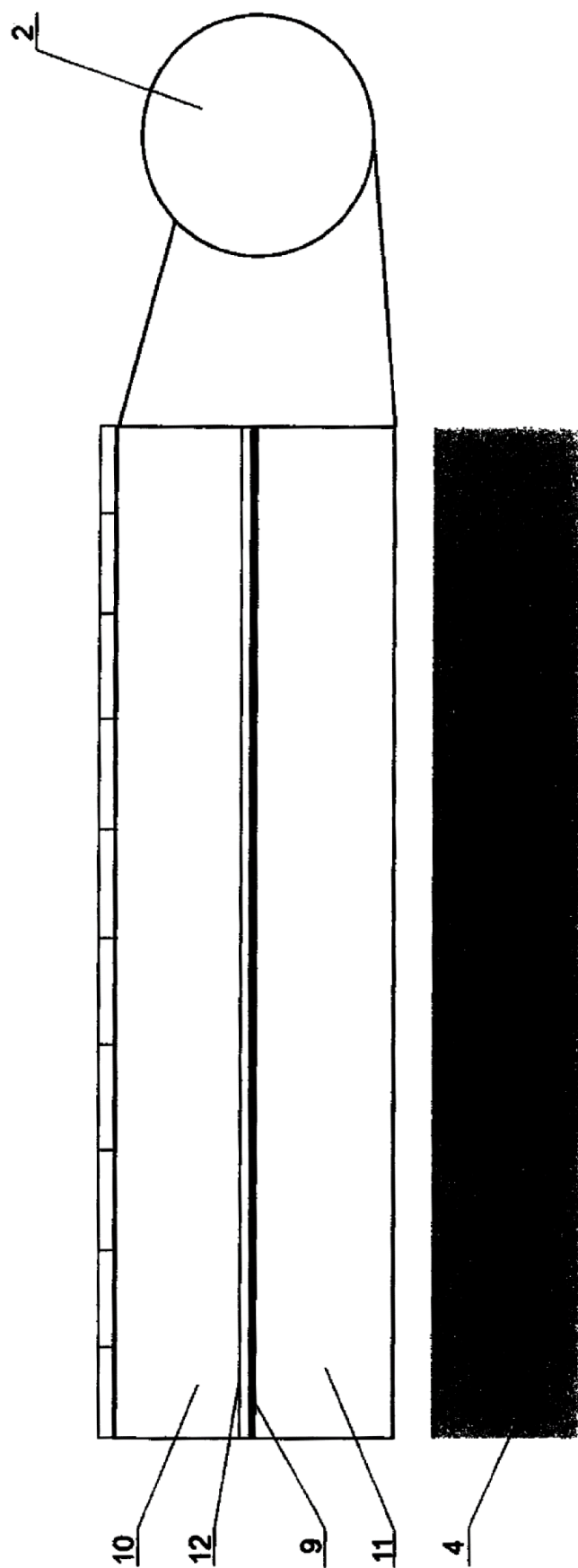


fig. 3

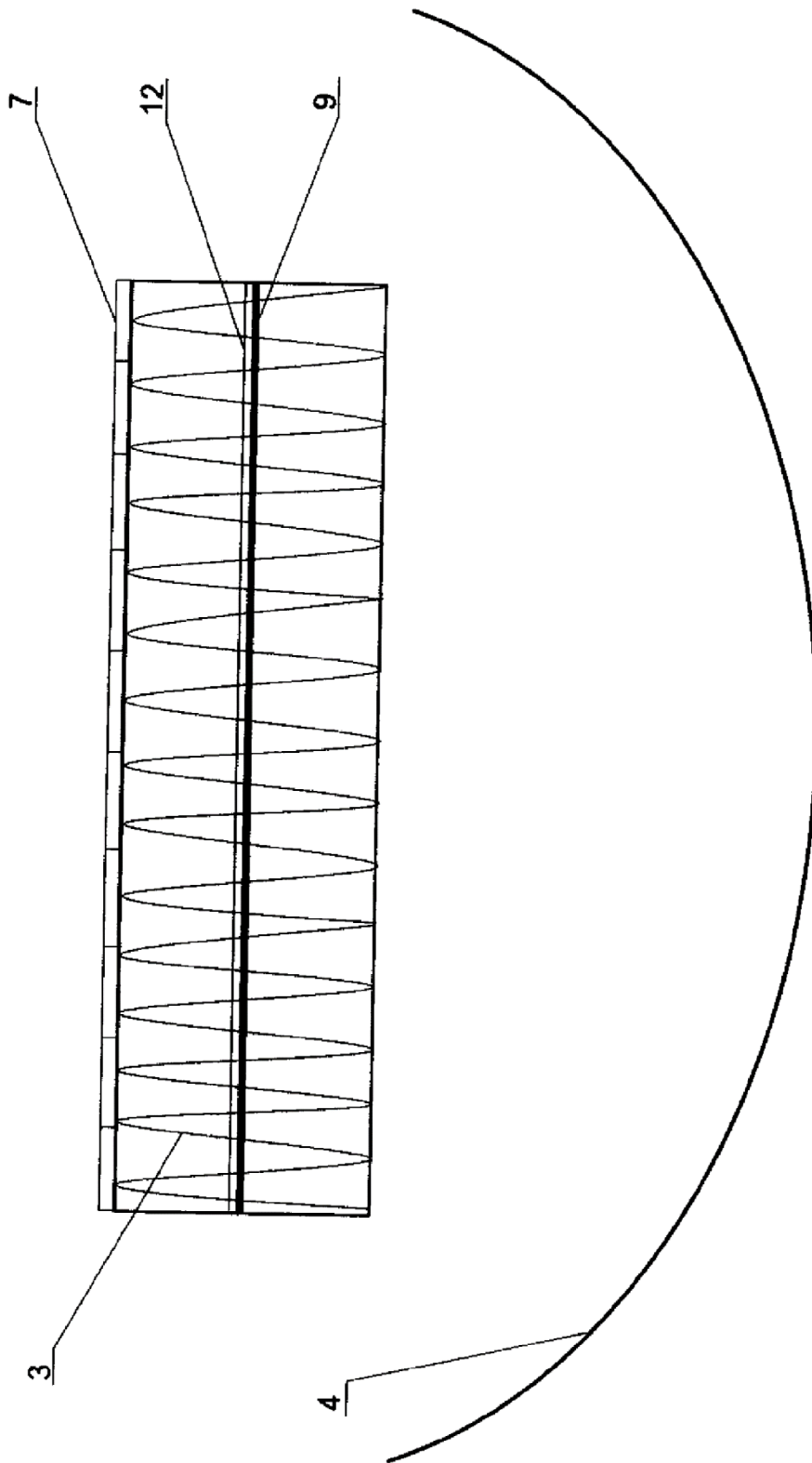


fig. 4

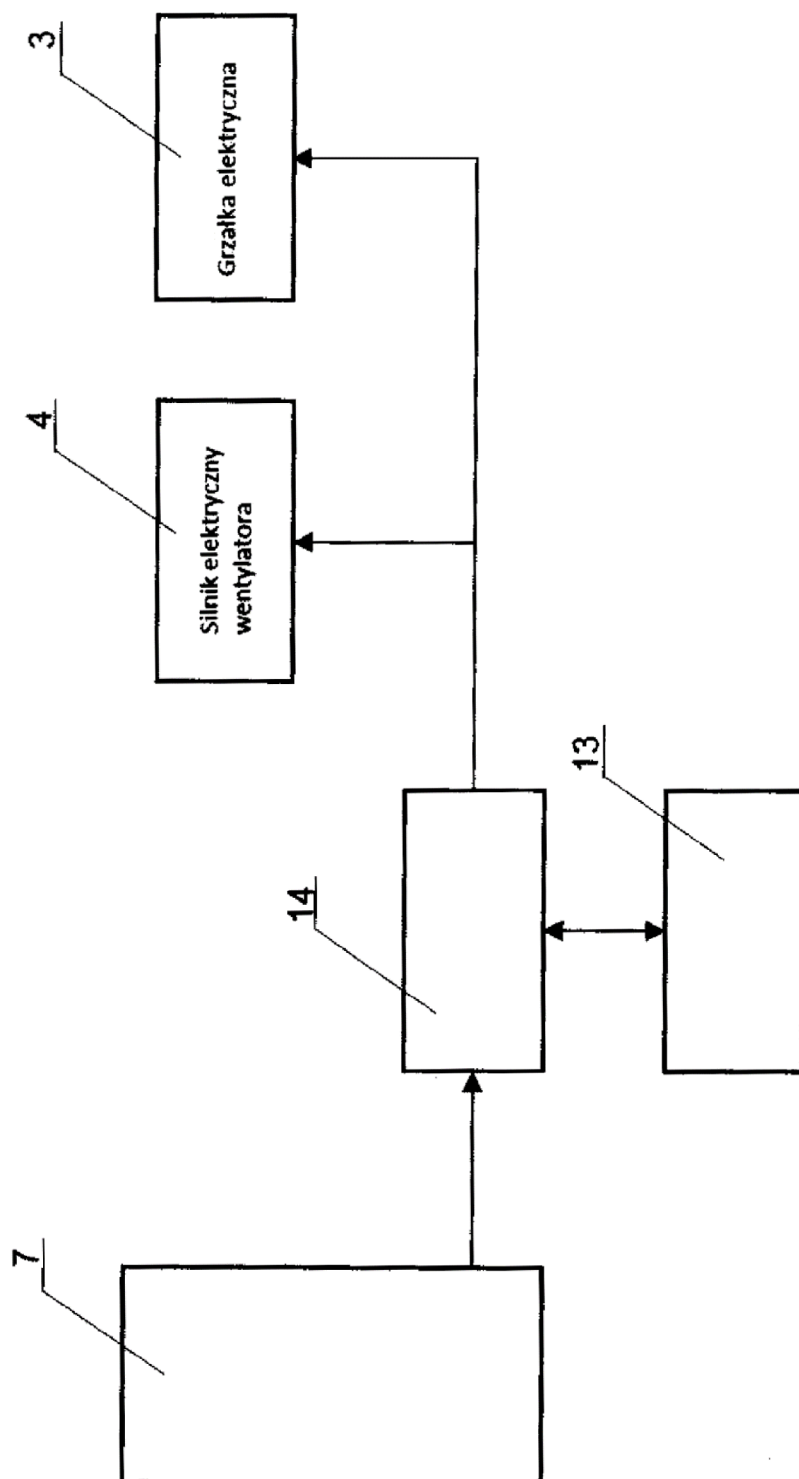


fig. 5



Espacenet

BG111811A METHOD AND A FULLY AUTONOMOUS DEVICE-DRYER WITH FORCED VENTILATION FOR DRYING PRODUCTS BY USING SOLAR ENERGY (57)

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Classifications:

IPC **F26B23/10; F26B3/28;**

Priorities: BG11181114A 2014-08-28

Application: BG11181114A 2014-08-28

Publication: BG111811A 2016-02-29

Published as: BG111811A

METHOD AND A FULLY AUTONOMOUS DEVICE-DRYER WITH FORCED VENTILATION FOR DRYING PRODUCTS BY USING SOLAR ENERGY (57)

Abstract

The invention is in the field of the food industry and finds an application in drying herbs, mushrooms, fruits and vegetables by using only solar energy. The invention constitutes a method and device-dryer for fully autonomous drying with forced ventilation of products, with solar energy, whereby a fan (4), powered by a photovoltaic panel (3), draws in air from the ambient environment and creates a forced continuous air flow which passes through an air solar collector (2), so that the air is heated, after which it passes through an open drying chamber (15), in which are placed the products for drying. In the drying chamber (15) is placed a sensor for temperature and moisture (11), whose signals are passed to a controller (12), which controls the air flow, so that a relatively constant drying temperature can be maintained. The device can be installed everywhere, without the need for another energy source. The device can be implemented in a monoblock version or a split system, depending on the specific situation.

[54] **APPARATUS AND METHOD FOR BATCH DRYING USING A MICROWAVE VACUUM SYSTEM**

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[21] Appl. No.: 37,610

[22] Filed: **Apr. 13, 1987**

[51] Int. Cl.⁴ **B01K 5/00**

[52] U.S. Cl. **34/60; 34/77; 34/133; 34/45**

[58] Field of Search **34/1, 77, 133, 109, 34/92, 68, 242, 45, 60**

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Primary Examiner—Henry A. Bennet

Attorney, Agent, or Firm—Allegretti & Witcoff Ltd.

[57] **ABSTRACT**

A mechanism for batch drying of a powdered or particular product with a microwave vacuum system is disclosed along with a method of controlling the drying process. The mechanism includes a chamber for drying the product. The product is contained in an internal product container. The product container and chamber are coordinated to allow easy opening on a rail system. The mechanism includes a means for inducing a vacuum in the chamber that can also with draw solvent vapor from the chamber. A source of microwaves for the chamber is provided, and the product container has an agitation mechanism for the product. A means for controlling the drying operation is also disclosed. The preferred embodiment of the mechanism include a solvent recovery system. The method of controlling the drying process allows for the selective halting of the drying operation upon achieving selectable parameters. The control systems also allows selectable parameters to be maintained during the drying operation.

39 Claims, 8 Drawing Sheets

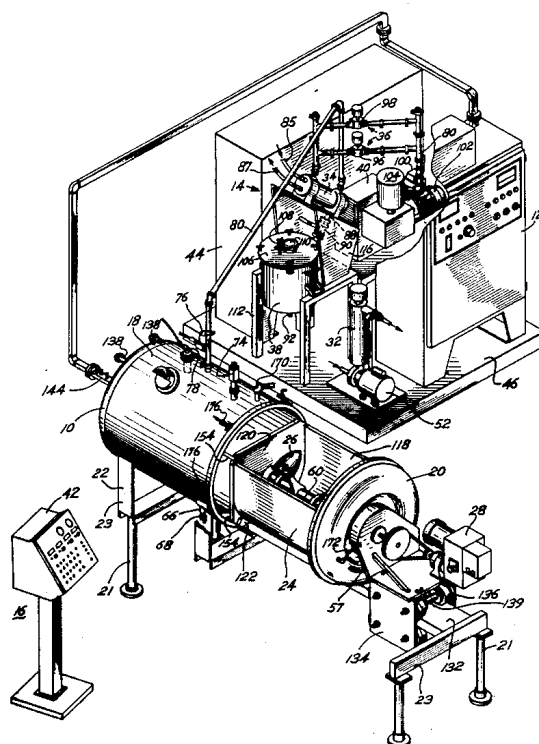
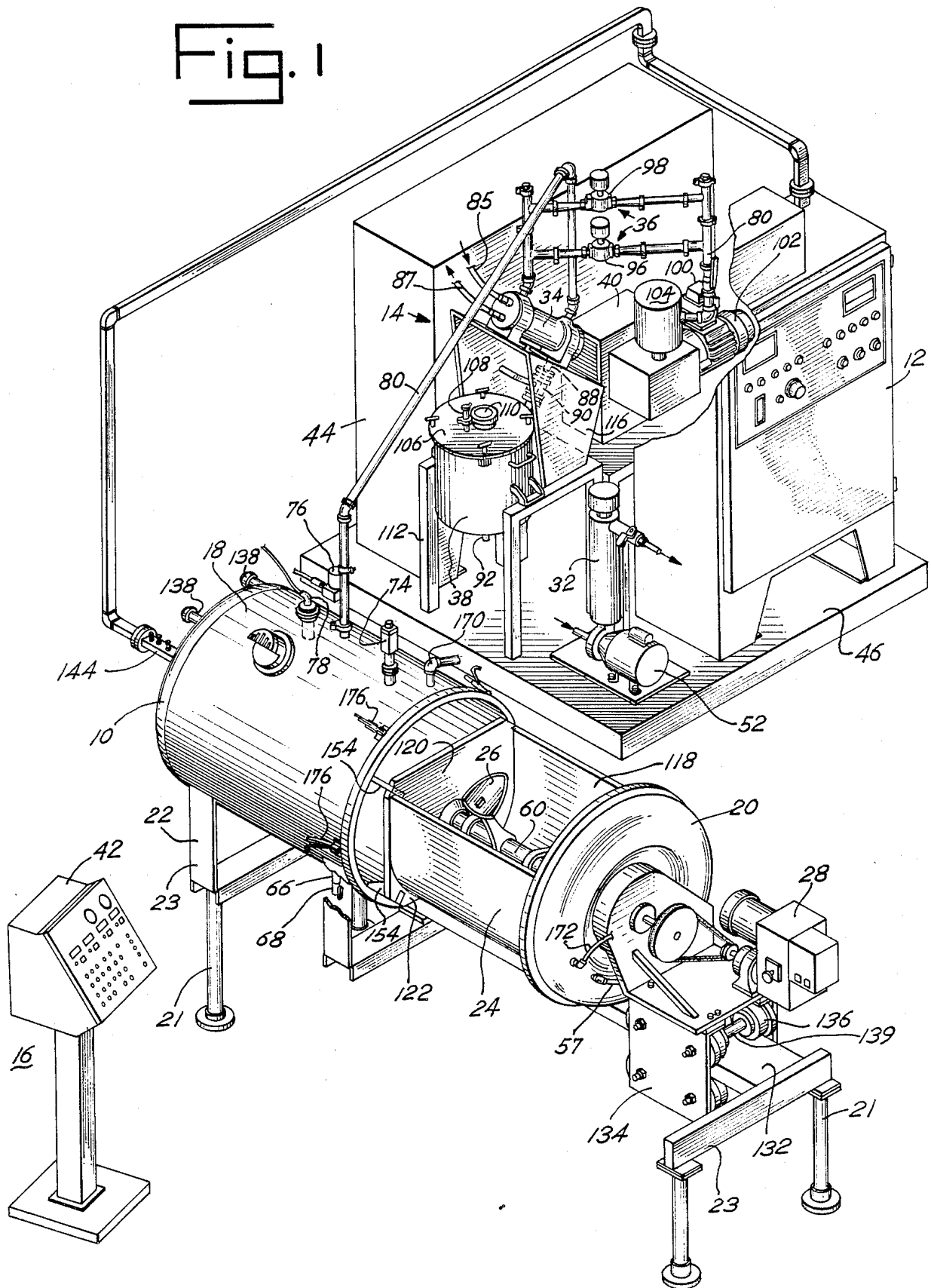


Fig. 1



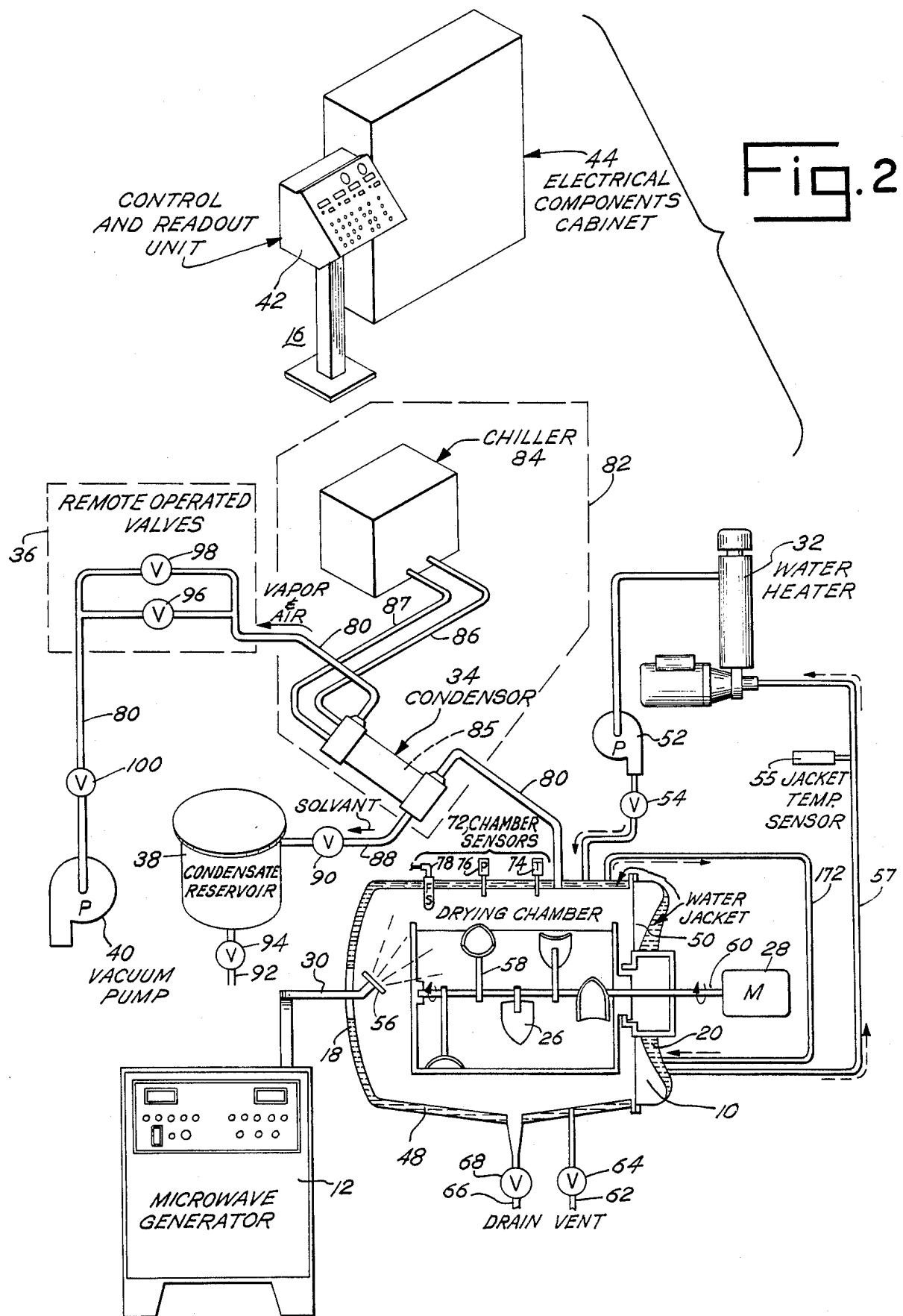


Fig. 3

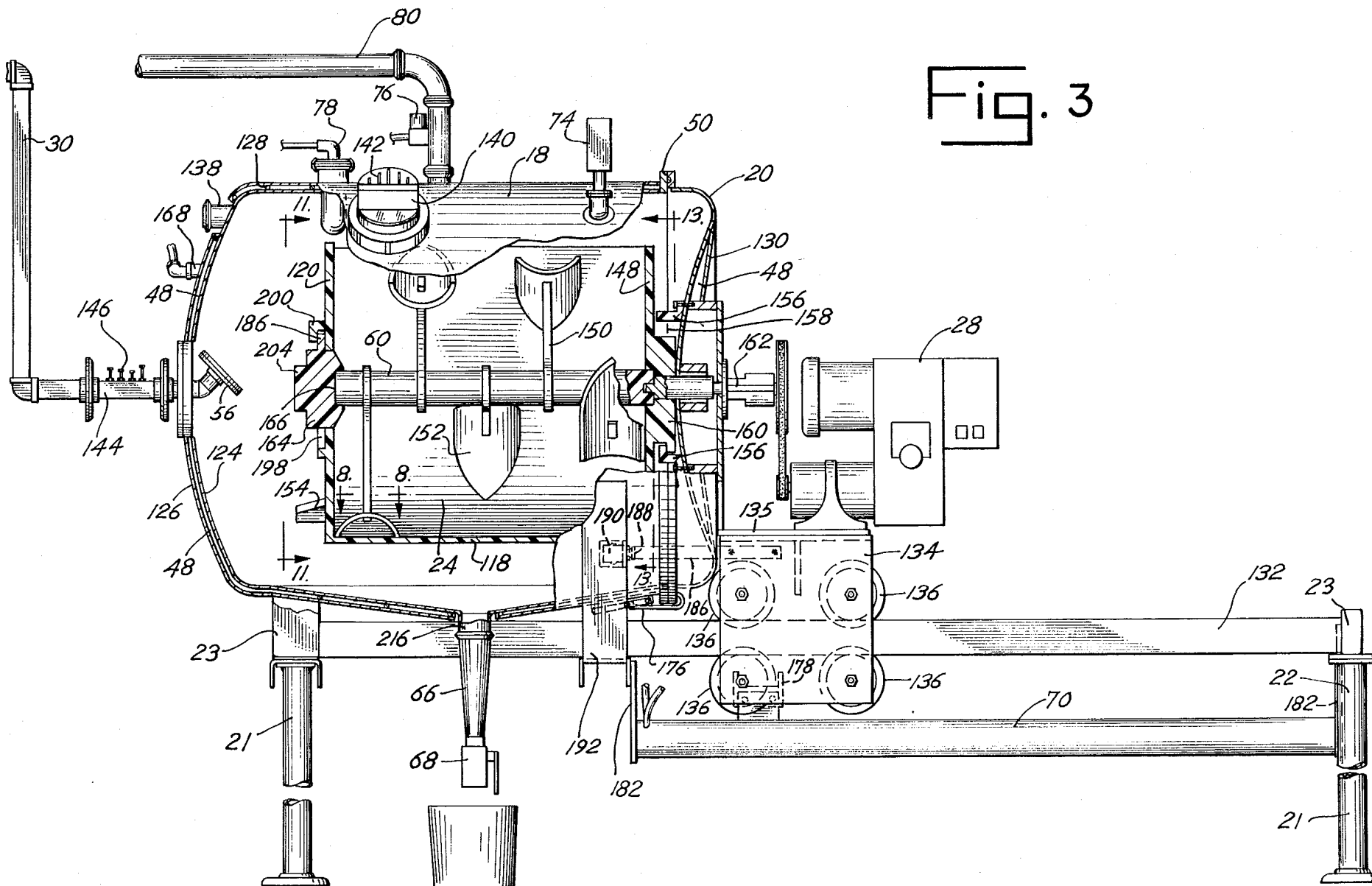


Fig. 4

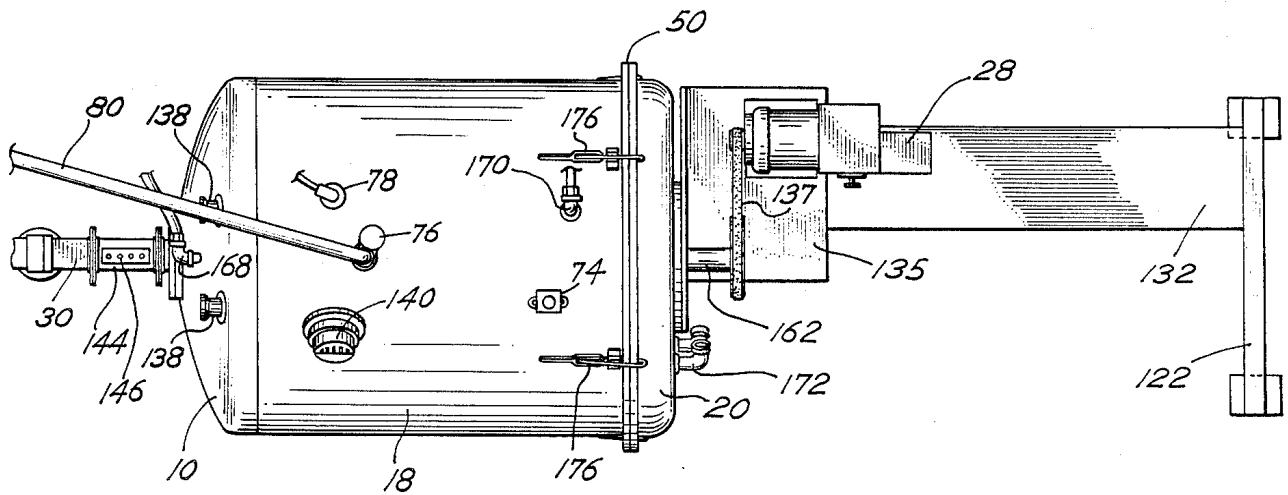
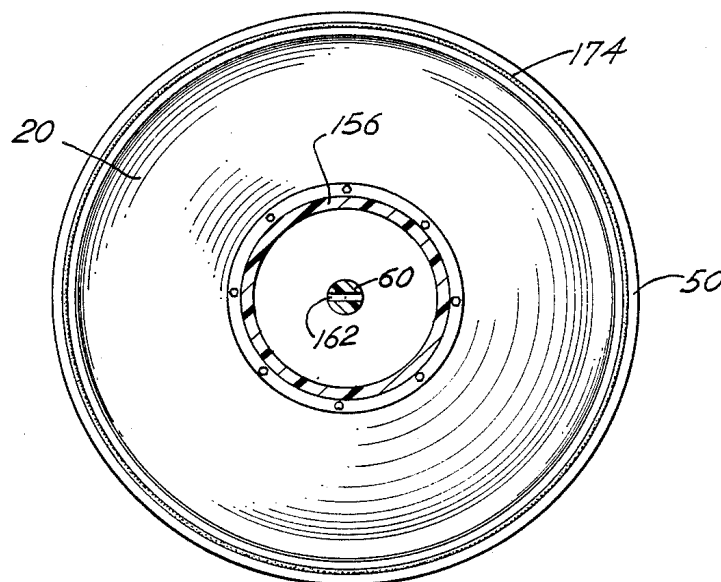
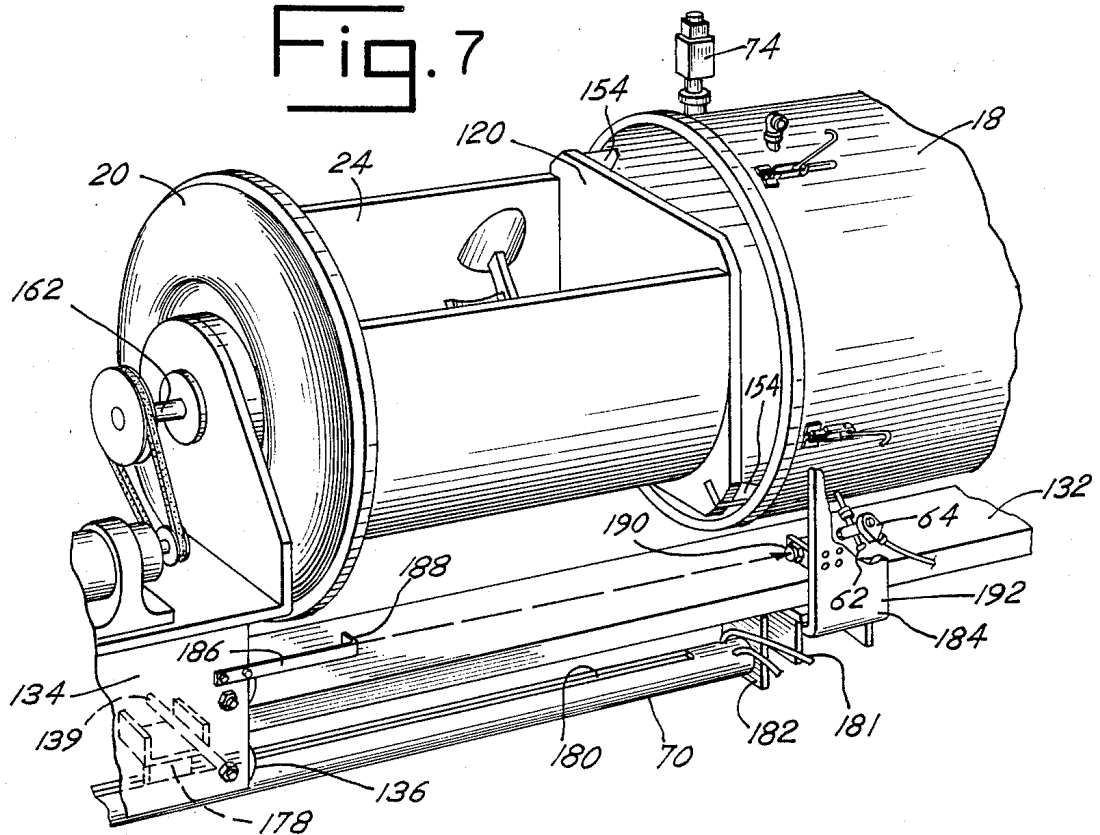


Fig. 5





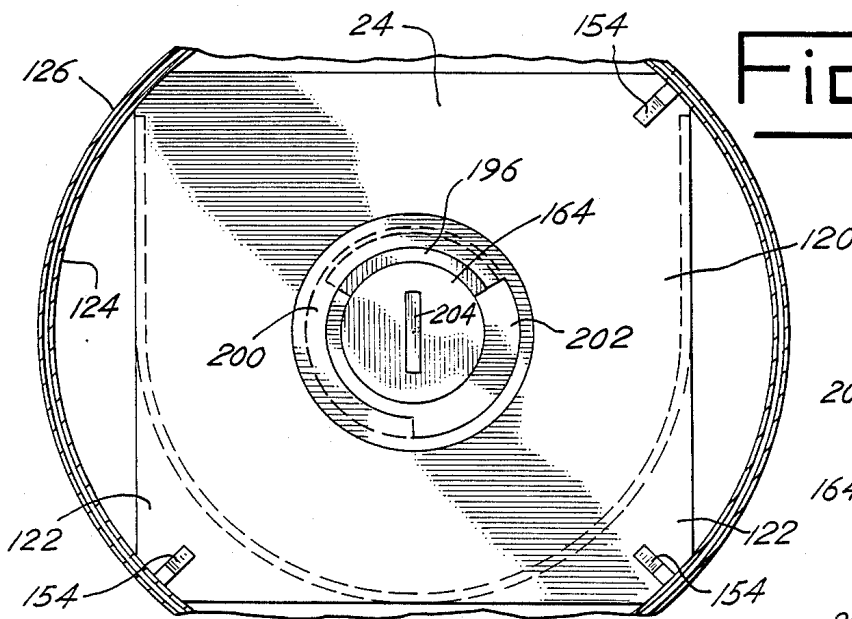


Fig. 11

Fig. 12

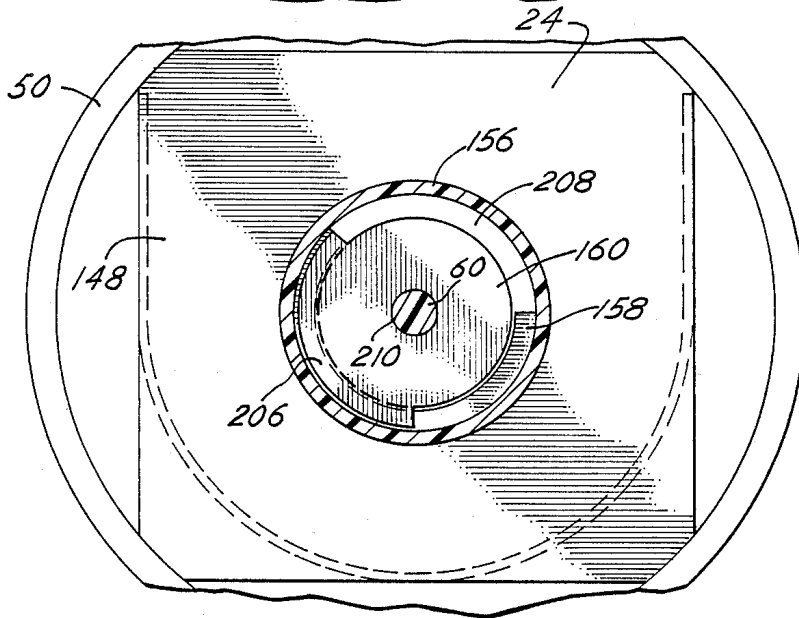
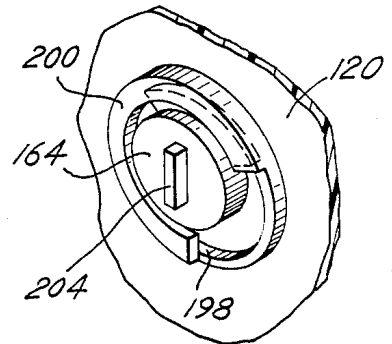


Fig. 13

Fig. 14

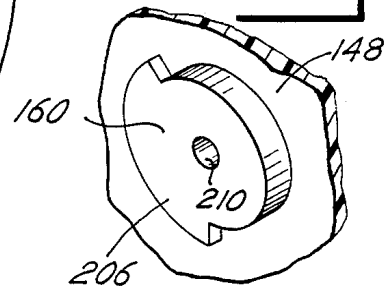


Fig. 10

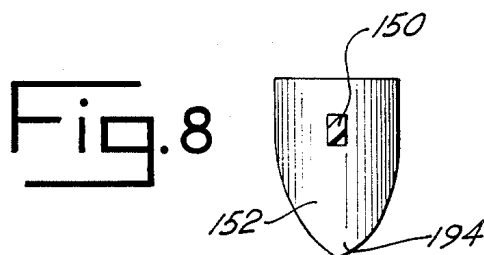


Fig. 8

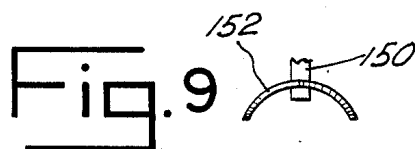


Fig. 9

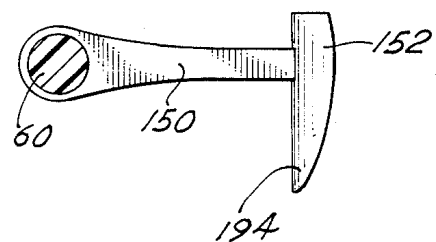


Fig. 15

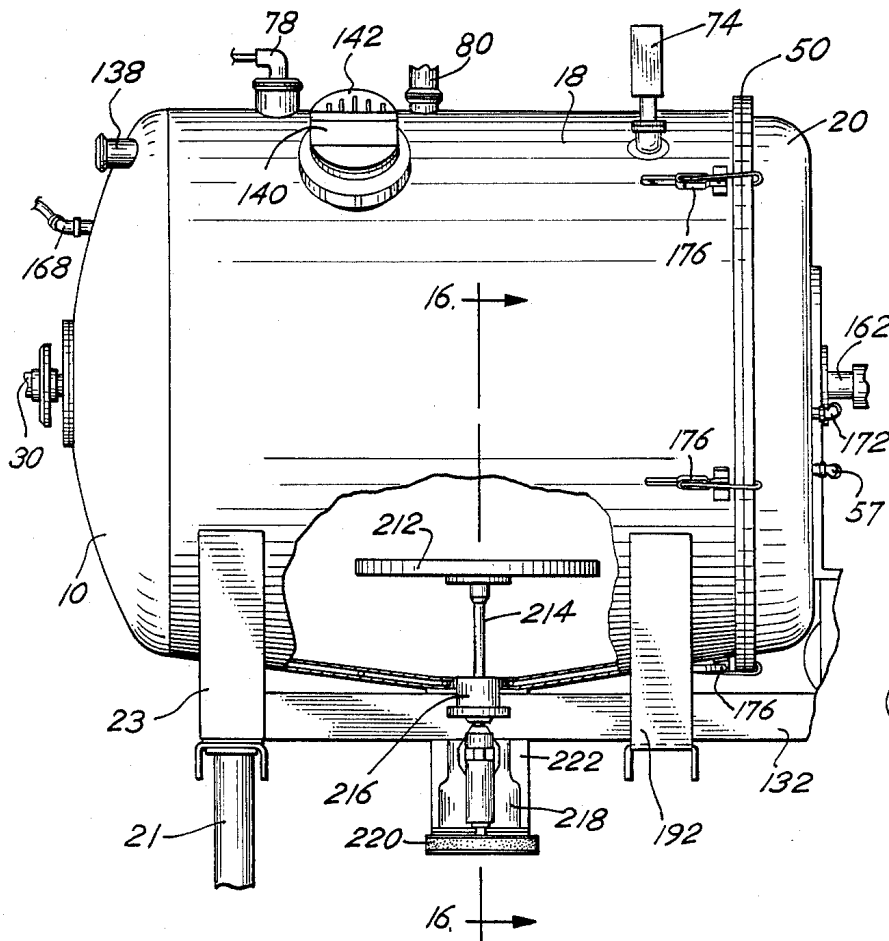


Fig. 16

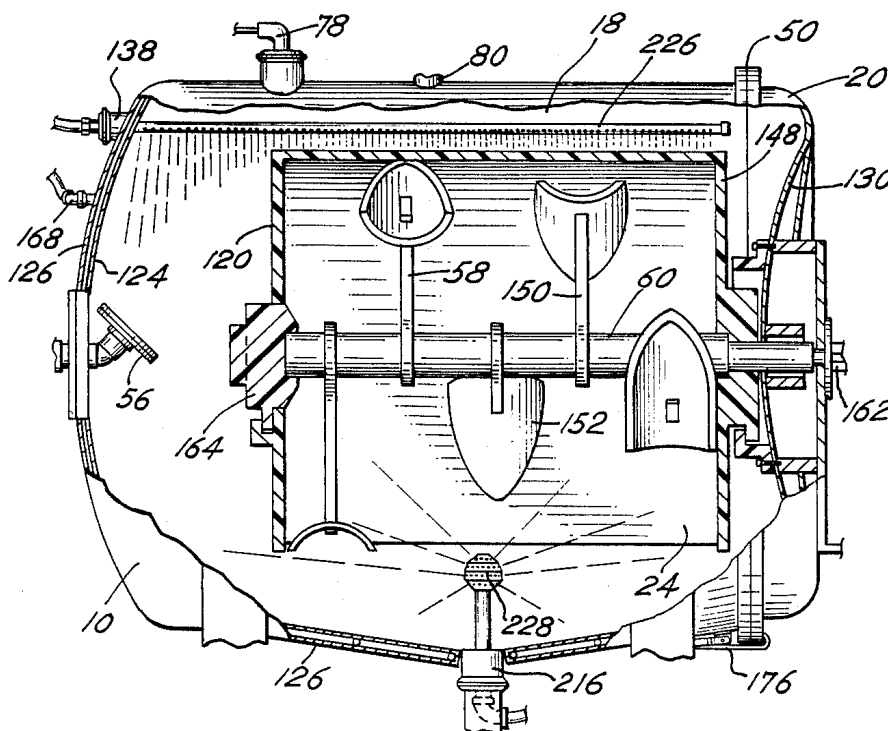
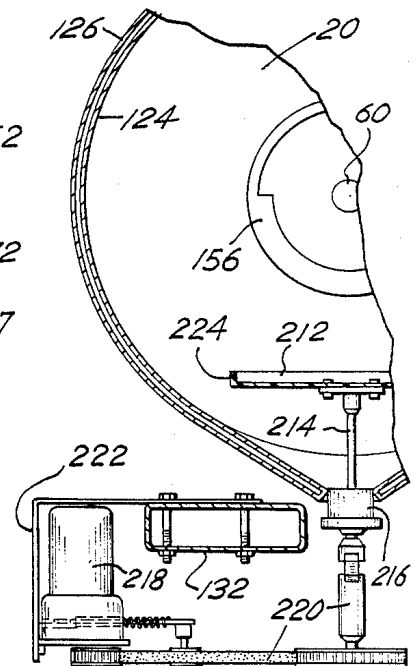
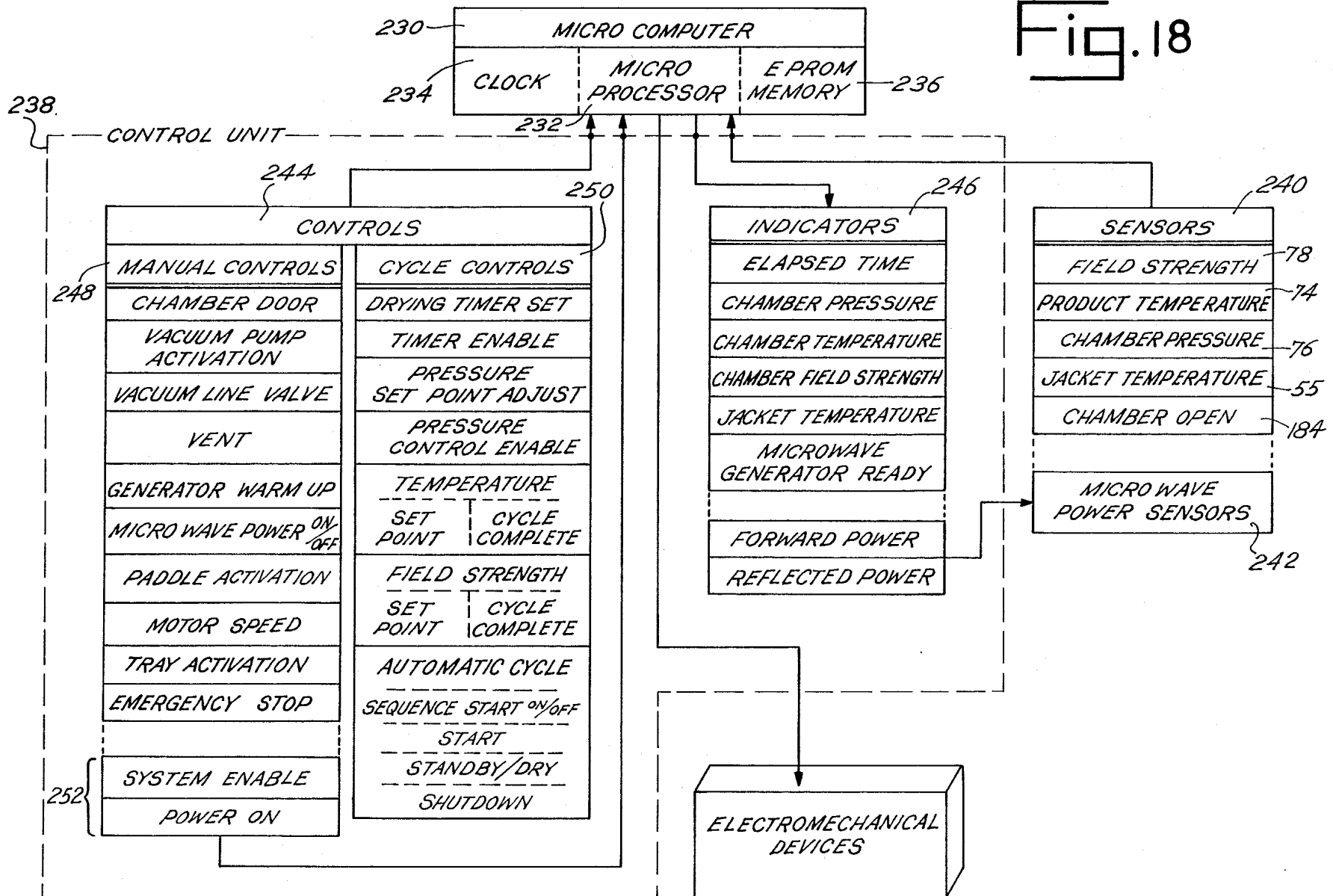


Fig. 17

Fig. 18



APPARATUS AND METHOD FOR BATCH DRYING USING A MICROWAVE VACUUM SYSTEM

BACKGROUND OF THE INVENTION

This application relates to mechanisms and processes for drying products in a microwave field. More particularly, the invention disclosed and claimed in this application relates to an apparatus and method particularly suited for microwave vacuum drying, in batch sequences, of powdered or particulate materials in the pharmaceutical, chemical and food industries.

Microwave vacuum drying on an industrial scale has been used, among other places, in agricultural applications (for seed drying) and in related industries. Such processes normally involve drying products in a vacuum chamber containing a field of microwave energy. The vacuum reduces the boiling temperature of the product's solvent. The solvent is often water but can be a variety of other substances. The microwave energy raises the temperature of both the product and its solvent to the solvent's boiling temperature, and then provides the latent heat of vaporization.

The combination of microwaves and vacuum has been found to produce quick, low-temperature drying with little product loss and little chance for fire or explosion—the latter safety factor is especially important when powdered or dust-containing materials are dried. Additionally, the microwave vacuum drying process provides inherent solvent recovery.

In the past, microwave vacuum drying processes have been applied to a large variety of products. Such processes have, for example, been applied to seed drying, as disclosed in McKinney, U.S. Pat. No. 4,015,341 issued for a "Seed Drying Process and Apparatus", and to frozen materials, as disclosed in Bradbry, U.S. Pat. No. 2,513,991 issued for a "Process for the Desiccation of Aqueous Materials from the Frozen State". The process has also been applied to food products, as disclosed in Jeppson, U.S. Pat. No. 3,409,447 issued for "Treating Food Products with Microwave Energy and Hot Gas of Decreasing Humidity". Microwave vacuum processes have also been used in the pharmaceutical and food industries.

Although some batch microwave drying devices have been built and used in the past, and although batch devices have been used in the pharmaceutical, chemical and food industries, the use of such machines is not well developed. Many of the batch drying machines have been laboratory machines, not wholly suitable for high volume commercial drying. Continuous operations are often suitable in many food and chemical industries. However, batch operations are especially important in the pharmaceutical industry because of federally mandated requirements for records on each batch of pharmaceuticals prepared. Batch drying processes are also useful in the food and chemical industries for products produced in discrete segments or smaller amounts. Accordingly, a need exists for further development in the field of batch microwave vacuum drying in commercial quantities, especially in the pharmaceutical, chemical and food industries.

Vacuum drying operations have limitations different from conventional drying operation. For example, the solvent, often water, will condense at a lower temperature than normal due to the introduction of a vacuum. The lower condensation temperature will cause the

walls and windows of the drying chamber to be covered with solvent condensate, which will accumulate in the chamber unless some means is provided to prevent condensation or to remove the condensate.

Use of a microwave drying process poses other problems, most stemming from the likelihood of uneven microwave distribution within the drying chamber. Microwaves can only penetrate the product to be dried to a limited depth, a depth that varies from about one quarter inch to four inches, depending on the product. To protect workers and operators of the drying apparatus, microwave devices must also have a complete metal enclosure; yet the field strength of microwaves becomes zero at the surface of a metal wall. The product must therefore be kept at least one quarter wavelength from the surface of the metal wall, a distance that is approximately 1.2 inches. The shape of the metal container also affects the field strength within the heating chamber. For example, a sharp metal point produces a high field strength at the point's tip. Microwave vacuum dryers therefore should be designed with smooth interior curves to produce few, if any, areas of extreme energy concentration.

In the past, the most common form of microwave vacuum dryers for batch processes have been lab structures with rotating trays. Such trays are usually circular and allow the product to be either loaded directly onto the tray or placed in a container that is set on the tray. Generally, rotating trays are difficult to load and unload, especially if the product is spread on the surface of tray, because the product must be spread evenly across the entire tray. For pharmaceutical or chemical powders, the maximum thickness that will allow even drying is one to two inches. Additionally, even drying throughout the product can be achieved only if the product is kept near the outer edge of the tray, since the movement of the product through the uneven microwave field is greatest along that edge.

A more suitable approach for batch microwave drying is the use of product container in the form of a tumbling drum. Such drum configurations have been attempted by the inventor, but have posed several problems. The entire drum must be transparent to microwaves, which for all practical purposes requires the drum be constructed of hard microwave-transparent plastics. Such plastics, however, make poor gaskets, meaning that difficulties arise in sealing the drum to contain the product. Additionally, a vapor exhaust point must be provided in the drum, and the most convenient location for that exhaust point is the axis of rotation. If a small opening is used, the opening will act as a venturi, increasing the velocity of the exiting vapor so that the vapor will flow from the drum at a high velocity. The high velocity vapor movement will usually pull powders or other granulated material along with the vapor. A larger opening will reduce the venturi effect, but will limit the capacity of the drum. Moreover, rotating drums need a microwave transparent rotating mechanism to effect the rotation.

As an alternative to rotating drums, microwave batch vacuum drying operations can be accomplished using a product container having internal agitators. Design of a structure with internal agitation poses a variety of difficulties, including the need for a thorough and even mixing with little fracturing of the product. The container design also should avoid corners that will trap the product to be dried and prevent standing water or sol-

vent spots. Any container design must also allow easy loading and unloading of the product.

Control of a batch microwave vacuum drying process requires consideration of several factors. For example, microwaves are most often absorbed better by the product solvent than the product itself. The amount of energy absorbed by the product/solvent combination therefore decreases as the percentage of solvent within the product decreases. During vaporization of the solvent, the combined product/solvent temperature will remain relatively stable, since energy absorbed by the solvent will be used for the vaporization. However, as vaporization nears completion, the combined product/solvent temperature will begin a more rapid temperature change, if the microwave field is not changed to compensate.

Different products also have different drying requirements. For example, the maximum temperature that is acceptable for a product varies depending upon the product. Additionally, different products may require different degrees of solvent retained within the product; complete drying is rarely desirable.

One conventional form of control for drying processes is a simple elapsed time control that halts drying after a predetermined period. Of course, other more complicated control systems have been used as well. Elapsed time control, while effective, often does not provide the versatility necessary to precisely control the drying and drying temperature of products. This is especially true for pharmaceuticals, which require exact control of all the product's characteristics.

OBJECTS OF THE INVENTION

Accordingly, it is an object of this invention to provide a microwave vacuum drying apparatus and process that is usable primarily in the pharmaceutical, chemical and food industries.

An additional object of this invention is to provide such a microwave drying apparatus that allows for easy product loading and unloading.

A further object of this invention is to provide a microwave vacuum drying apparatus and process that results in even drying of the product.

Another object of the invention is to provide a microwave drying apparatus and process that operates on a batch basis.

Yet a further object of this invention is to provide a microwave vacuum drying apparatus that is sanitary and easily cleaned.

Still another object of this invention is to provide a microwave vacuum drying apparatus that results in even microwave distribution throughout the dried product.

Yet a further object of this invention is to provide a microwave vacuum drying apparatus and process that results in accelerated drying of the products.

Still another object of this invention is to provide a microwave vacuum drying apparatus that has a commercial volume capacity.

Still a further object of this invention is to provide a microwave vacuum batch drying apparatus and process that provides for even exposure to the microwaves and thus even drying of the product, with little fracturing or destruction of the product elements.

Yet another object of this invention it to provide a microwave vacuum drying apparatus that prevents solvent condensate from accumulating on the interior walls of the apparatus.

An additional object of this invention is to provide a microwave vacuum drying apparatus and process that is versatile, so that it may be applied to a variety of different products.

A further object of this invention is to provide a versatile control system for a batch microwave vacuum drying apparatus and process.

Yet a further object of this invention is to provide a batch microwave vacuum drying apparatus control and process that is capable of responding to rapid changes in product and drying chamber characteristics.

Still another object of this invention is to provide a microwave vacuum drying apparatus that minimizes product and solvent loss.

SUMMARY OF THE INVENTION

These and other objects of the invention are accomplished by providing a mechanism for batch drying of powdered or particular products using a microwave vacuum system. A method of controlling the drying process is also provided. The mechanism includes a chamber for drying the product with an internal product container, a means for producing a vacuum in the chamber, a source of microwave energy and a means of introducing that energy into the chamber, an agitation mechanism for the product, and a means for controlling the product's drying operation. The agitation mechanism is integral to the product container. The preferred embodiment of the mechanism also includes a solvent recovery system. The product container and chamber are coordinated to allow easy chamber opening and easy product dumping. The preferred embodiment connects the chamber's head and the product container for joint movement on a rail. The controlling method allows for the selective cessation of the drying operation upon achieving selectable parameters. The control systems also allows selectable parameters to be maintained during the drying operation, if desired.

Other objects, advantages, and applications of this invention are apparent from the following detailed description of the preferred embodiment and explanation of practice of the method of the invention. The description and drawings are intended for purposes of illustration only, and the invention is limited only by the provisions in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The principal embodiments of the present invention is disclosed in the detailed description of the drawings. The drawings include eighteen figures to illustrate the embodiments and the practice of the method, wherein like reference numerals in each drawing refer to like elements of the various figures.

The drawings are briefly described as follows:

FIG. 1 is a perspective view of the elements of the preferred embodiment of the mechanism of this invention.

FIG. 2 is pictorial illustration identifying the individual elements of the mechanism and showing the relationship of the various fluids used in the system.

FIG. 3 is a side cut-away view of the preferred embodiment of the chamber of FIG. 1, showing the product container support.

FIG. 4 is a top view of the microwave chamber of FIGS. 1 and 3.

FIG. 5 is a cross-sectional view of the chamber of FIG. 3, illustrating the chamber head and its seal and the shaft of the product agitation system.

FIG. 6 is a perspective illustration of the chamber illustrated in FIGS. 1 and 3, and further illustrating the mechanism for dumping dried product from the chamber.

FIG. 7 is a rear perspective view of the chamber of FIGS. 1 and 3.

FIG. 8 is a top cross sectional view of the blade portion of the agitator paddles used in the preferred embodiment of the invention.

FIG. 9 is an end view of the blade of FIG. 8.

FIG. 10 is a side cross sectional view of the paddle of FIGS. 3 and 8, further illustrating the arm of the agitator paddles.

FIG. 11 is a cross sectional view of FIG. 3, illustrating the inner end of the product container.

FIG. 12 is a perspective view of the inner end of the product container illustrated in FIG. 11.

FIG. 13 is a cross-sectional view of the chamber and product container mount of FIG. 3.

FIG. 14 is a perspective view of the product container mount of FIG. 13.

FIG. 15 is a cut-away side view of the chamber of FIG. 3 showing a tray as an alternative arrangement for a product container.

FIG. 16 is a cross-sectional view of the embodiment of FIG. 15, illustrating the tray's drive motor and mount.

FIG. 17 is a cut-away side view of the chamber of FIGS. 1 and 3, illustrating operation of a clean-in-place mechanism.

FIG. 18 is a graphic illustration of the control and sensor operation, and their relationship to the control and readout unit.

In the following detailed description, directional terms such as "upper", "lower" and the like are used for the convenience of a person of ordinary skill in the art, and are not to limit the scope of any patent issuing on the present invention, unless expressly included in the claims.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT AND DETAILED EXPLANATION OF THE METHOD OF THE INVENTION

Referring now to the drawings, an explanation will be provided of the preferred method of practicing the method of this invention, and a description will be made of the preferred embodiment of the mechanism of this invention. It is to be understood that the mechanism described in this description and shown in the attached drawings is only one of several different mechanisms appropriate for the practice of the method of this invention. Similarly, the mechanism described and shown in the drawings illustrates but a few of the various mechanisms that embody the apparatus claimed. The method and apparatus of this invention are limited only by the language in the claims and not by any statements made in the following description.

The principal elements of the preferred embodiment of the invention are illustrated in FIG. 1. Generally, the invention comprises a drying chamber 10, a microwave generator 12, components of fluid system 14 and a control system 16. Together, those elements comprise the main components of the apparatus in the invention's mechanism and are suitably configured for performance of the method of the invention.

The drying chamber 10 includes a body portion 18 and a chamber head 20. Both the body and the chamber

head are mounted on a chamber stand 22. The chamber stand includes legs 21 and frame 23. The body and chamber head are supported by the stand when the chamber 10 is both open and closed; FIG. 1 illustrates the drying chamber 10 opened. The product to be dried is placed in a product container 24. In the preferred embodiment, the product container is mounted on the chamber head 20, but is supported by both the chamber head and body. The preferred embodiment of the mechanism also includes an agitation mechanism 26 driven by a drive motor 28.

The microwave generator 12 is connected to the drying chamber 10 by a wave guide 30. The wave guide is preferably made of aluminum to ensure good transmission and total containment of the microwaves.

The components of the fluid system include a water heater 32, a condenser 34, a chiller 84 (illustrated in FIG. 2), a valve system 36, a condensate reservoir 38, and a vacuum pump 40. The components of the fluid system are connected by a series of hoses that are not entirely illustrated in FIG. 1, but are described in the specification and later figures.

The control system includes a series of sensors, a control and readout unit 42, an electrical component cabinet 44, and interconnecting wiring. The microwave generator 12, fluid system 14, and electrical components cabinet 44 are all, in the preferred embodiment, mounted on an equipment platform 46.

The operative relationship between the various elements is best illustrated by reference to FIG. 2. Beginning with the location of the drying operation, the drying chamber 10 is surrounded by a heated water jacket 48. The warm water provides a heat source to heat the chamber 10 that prevents condensation of vaporized solvent onto the interior of the chamber's surface. A seal 50 separates the chamber main body 18 from the chamber head 20. The water jacket extends around both the main body 18 and the chamber head 20, and is connected between those chamber elements by a hose (not shown) extending across the chamber seal 50. Hot water for the water jacket is provided by the water heater 32. The water is pumped by a water pump 52 to the body portion 18 of the chamber, and after flowing throughout the water jacket, returns from the chamber head portion 20 to the water heater. The water is constantly recirculated since it is used only for heating. In the preferred embodiment, a manually operated valve 54 can be used to shut off flow from the water heater 32 to the water jacket 48. A jacket temperature sensor 55 is positioned in the return line 57 between the chamber head 20 and water heater 32.

Microwave radiation is provided to the drying chamber 10 by the microwave generator 12, and travels through a conventional wave guide 30. The microwave radiation is directed through the microwave inlet window 56, which is positioned to direct the microwaves to reflect off the upper part of the drying chamber 10 and thereafter reflect throughout the chamber 10.

An agitation mechanism 26 is mounted in the product container 24. It includes paddles 58 rotating about a shaft 60 and extending through the chamber head 20. The shaft 60 is driven by the drive motor 28. The drying chamber also includes an air cylinder 70 that separates the chamber head 20 from the chamber body 18 upon a remote command.

The drying chamber also includes a vent 62 to allow the chamber to return to atmospheric pressure. The vent 62 is operated by a remote controlled valve 64.

The chamber also has a drain 66 to allow removal of any condensation that does occur on the drying chamber's inner surface. The drain also allows removal of any cleaning fluid in the chamber left after a cleaning operation. The drain is controlled by a manual valve 68.

Chamber sensors 72 are mounted on the drying chamber 10. The sensors monitor conditions within the chamber and send that information to the control and read-out unit 42. In the preferred embodiment, the sensors consist of an infrared product temperature sensor 74, a chamber pressure sensor 76 and a chamber field strength sensor 78. The chamber pressure sensor 76 may be connected directly to the drying chamber, or, as in the preferred embodiment (and illustrated in FIG. 1), may be positioned in the vacuum line 80 extending away from the drying chamber.

The vacuum within the drying chamber 10 is produced by the vacuum pump 40. The vacuum pump draws air and solvent vapor from the drying chamber through the condenser 34 and the remote operated valve system 36. The pump 40, valves 36, and condenser 34 are connected by a vacuum line 80.

The condenser 34 is part of a condenser unit 82, which consists of the condenser, a chiller 84, and the coolant line 86. Coolant flows into the condenser through inlet line 85, and out through outlet 87. Condensate from the condenser 34 flows through the condensate line 88 to the condensate reservoir 38. To allow movement of the condensate reservoir and the solvent it contains away from the condenser, condensate valve 90 is located in condensate line 88 between the condenser and condensate reservoir. If desired, solvent condensate can be drained from the condensate reservoir 38 through drain 92. Flow from the condensate reservoir is controlled by manually operated drain valve 94. Because the condenser is acting in a vacuum system, the condensate reservoir is also maintained at the same pressure. Accordingly, valves 90 and 94 are sealed against both liquid and gas leakage, and condensate reservoir 38 is pressure-sealed as well.

Pressure within the drying chamber 10 is maintained by operation of the valve system 36. The entire system is maintained in a vacuum during a drying operation. The valve system consists of a large valve 96 and a small valve 98. Both the large and small valves are remote operated. Two valves are used to ease maintenance of the drying chamber at a constant pressure. Both valves are "two position" valves that are either wholly open or wholly closed. As an alternative, a single valve may be used, such as an diaphragm valve, that provides for varying quantities of flow through the vacuum line 80. When dual valves are used, as in the preferred embodiment, the larger valve is opened by the system's control unit, and air flows from the chamber until the drying chamber achieves the desired drying pressure. The large valve 96 is then shut. Vacuum is maintained at the desired pressure by opening and closing the small valve 98 as necessary, and the vacuum pump 40 operates continuously throughout the drying operation. Through use of that system, an accurate vacuum can be more consistently maintained in the drying chamber 10 than when diaphragm valve is used. In the preferred embodiment of the mechanism, a manual valve 100 is positioned in the vacuum line 80 between the valve system 36 and the vacuum pump 40. If desired, manual valve 100 can be used to stop all flow through the vacuum line 80.

Control of the system is accomplished by electrical equipment contained within the control and read out unit 42 and the electrical component cabinet 44. The sensors, remote operated valves, drive motor, microwave generator, air cylinder, water heater pump, and vacuum pump are controlled by the electronics of the control and read out unit and electrical components cabinet.

Referring again to FIGS. 1, 3 and 4, various details of the elements of the invention's mechanism are further disclosed. Beginning with the fluid system 14, the vacuum pump 40 includes a pump motor 102 and an air filter 104. The condensate reservoir has a removable chamber head 106, a back-to-atmosphere vent 108 and a viewing window 110. In the preferred embodiment, the condensate reservoir 38 rests on a reservoir stand 112 and is removable from that stand. The chamber head 106 of the condensate reservoir is secured with a series of quick-disconnect latches 114.

The condenser 34 is mounted on a condenser stand 116 positioned over the condensate reservoir 38 for easy of flow of condensed solvent into the reservoir. Also in the preferred embodiment, the chiller 84 sits beneath the vacuum pump 40 beneath the legs of the vacuum pump stand.

FIG. 1 illustrates the preferred embodiment of the product container 24. The container includes sidewalls 118 forming a trough. The inner end of the container has a bulkhead 120 with lower flanges 122 extending beyond the radius of the trough 118. The product container 24 is supported in the chamber body 18 by the lower flanges 122.

Referring particularly to FIG. 3, additional details of the construction of the drying chamber 10 are disclosed. As that figure illustrates, the drying chamber 10 is constructed of an internal shell 124 and an external shell 126. The space between the shells is maintained by spacer rods 128; that space is the water jacket 48. The spacer rods 128 are composed of a continuous rod wound around the inner shell 124. In the chamber head portion 20 of the drying chamber 10, the water jacket comprises the space between the chamber head 20 and a chamber plate 130. The water jacket for the chamber head 20 extends in an annular configuration around the chamber head's center. It does not extend radially to the chamber head's outer circumference.

Movement of the chamber head 20 away from the chamber main body 18 is best illustrated by FIGS. 3 and 4. The chamber stand 22 includes a rail 132 extending beneath the drying chamber 10. The chamber head 20 and drive motor 28 are both mounted on a shuttle 134, having a motor mounting plate 135. The shuttle in turn is attached to four rollers 136, two on each side of the rail. Each roller is mounted on an axle 139. Using that configuration, the combined chamber head, shuttle and drive motor unit can roll smoothly along the rail 132 when the drying chamber 10 is desired to be opened.

Other features of the drying chamber 10 are also illustrated on FIGS. 3 and 4. In its preferred embodiment, the drying chamber includes a port 138 through which elements of a clean-in-place system can be installed. The chamber also includes a view window 140 to allow an operator to look into the interior of the chamber. The view window is preferably a glass window having a metal screen covering the glass to prevent transmission of microwaves. In the preferred embodiment, the view window includes an internal light (not shown) mounted within the view window structure and

adapted to shine a light into the product container 24. Also in the preferred embodiment, the internal light acts as a heater to prevent condensation of solvent vapor on the window's inner surface. The preferred embodiment of the view window therefore also includes vanes 142 to bleed off excess heat from the view window's light.

The preferred embodiment of the mechanism of the invention also includes a tuning system for the wave guide 30. Thus, a conventional tuner 144 is installed in the wave guide adjacent the microwave inlet window. The tuner operates in the conventional manner, i.e., a series of bolts 146 are threaded into the tuner portion of the wave guide, and reflected power (i.e., power returning into the wave guide) is minimized by adjusting the length of the bolts in the interior of the wave guide by trial and error.

Additional details of the product container and the agitation mechanism are also illustrated by FIG. 3. In the preferred embodiment, the agitation mechanism is a series of paddles 58 mounted about the shaft 60. The shaft 60 is in turn mounted in both the rear bulkhead 120 and the forward bulkhead 148, and can rotate in those bulkheads. Each of the paddles consists of an arm 150 and a blade 152. The paddles are spaced evenly along the length of the shaft 60, and the sum of the widths of the blades 152 is nearly equal to the interior length of the product container 24; the blades can overlap. In that manner, all of the powdered or particulate product within the trough of the product container 24 will be agitated during the drying process, such that the effects of uneven microwave distribution will be minimized. The product container also has three wings 154 extending from the rear of the inner bulkhead 120. The wings 154 support the product container on the inner surface of the inner shell 124 when the product container is pulled from the main body of the drying chamber 18.

In the preferred embodiment, the product container 24 is mounted on the chamber head 20. Preferably, the mounting is accomplished by a radial tongue and groove arrangement. Thus, the chamber head 20 includes a mounting bracket 156 defining a groove 158. The mounting bracket and groove extend radially around the shaft 60, which extends out of the product container 24 through the forward bulkhead 148. Outside of the product container, the shaft 60 has a radial tongue 160 mateable with the groove 158. The tongue and groove mounting arrangement thereby holds the product container 24 against the chamber head 20, when the chamber head is opened by rolling the shuttle and chamber head along the rail 132 as best illustrated in FIG. 1.

Power from the drive motor 28 is transmitted to the shaft 60 through a drive shaft 162. The drive shaft 162 extends into the drying chamber 10 as it locks into the shaft 60 of the bulkhead 148 in a tongue and groove arrangement. The shaft 60 is thus removable from the drive 162 merely by pulling the shaft 60 away from the notch. In the embodiment illustrated in FIGS. 3 and 4, the power transmission between the drive motor 28 and the drive shaft 162 is by means of a pulley 137. Other means may be used without departing the scope of the invention, such a direct drive structure.

In the preferred embodiment of the invention, the shaft 60 is removable from the product container 24. Removability is accomplished by supporting the inner end of the shaft 60 in a latch plug 162. The latch plug 162 has a cylindrical hole 166 matching the shaft 60, and the shaft 60 is supported by and allowed to rotate freely

in the cylindrical hole 166. The latch plug 164 is then made to be removable from the inner bulkhead 120, thereby allowing disassembly of the latch plug, shaft and product container into separate elements from the chamber head.

To eliminate arcing, glow discharge and related microwave phenomena, the components of the mechanism that are contained within the drying chamber 10 need to be constructed of a material that is relatively transparent to microwaves. In the preferred embodiment, that material is polypropylene, although a variety of other materials are acceptable as well.

The input to the water jacket is hose and pipe unit 168. After flowing radially around the inner shell 124, the heating water exits from the exit pipe 170, as best illustrated in FIG. 4. A hose (not shown) then leads to the chamber head's water inlet 172, allowing circulation of the hot water in the chamber head before the water returns to the water heater 32 through return line 57.

The chamber seal 50 between the chamber main body 18 and the chamber head 20 is best illustrated by reference to FIG. 5. The seal is configured to ensure electrical conduction across the entire surface of the joint between the chamber head 20 and the chamber main body 18, and thereby prevent microwave leakage. Accordingly, the seal includes an O-ring 174 composed of a conductive material. FIG. 5 also illustrates extension of the shaft 162 through the chamber head. The same figure further illustrates attachment of the mounting bracket 156 to the chamber head.

Dumping of the product is best illustrated by reference to FIG. 6. Because the product container 24 is rotatable in the mounting bracket 156 about the axis of shaft 60, the product may be dumped from the product container 24 by rotating the container such that its open top is directed generally downward. Since the dried product is either powdered or granulated, the product will slide out of the smooth surface of the polypropylene container. It may be necessary, however, to manually rotate the shaft 60 to move the paddles from blocking flow of the product. When the product container is rotated, its inner end is supported by the body portion 18 of the chamber through the wings 154 extending from the inner bulk at 120. As illustrated in FIG. 6, the product container 24 can be constructed with only three wings. The fourth wing is helpful, but unnecessary to support the product container. Elimination of the fourth wing makes insertion of the product container into the chamber 10 less difficult.

FIG. 6 further illustrates various features of the chamber and its agitation mechanism. FIG. 6 includes illustration of the inner side of the latch plug 164, and the latches 176 that serve to clamp the chamber head 20 to the body 18 in a firm grip.

Referring now to FIG. 7, the preferred embodiment of the invention includes an air cylinder 70 allowing remote opening of the chamber head 20 from the body 18. In the preferred embodiment, the air cylinder is a rodless cylinder, having output rod 178 that moves in a slot 180. The air cylinder is preferably mounted by cylinder supports 182 affixed to the bottom of the rail 132 and operate by acting to move the axles 139 of the rollers 136.

FIG. 7 further illustrates the preferred location and configuration of the back-to-atmosphere vent 62 and its remote control valve 64. The vent and valve are located on the lower portion of the product chamber. The vent and valve are therefore beneath the product container

20 to prevent powdered product from being blown out of the product container or off the tray when the chamber is vented.

Still referring to FIG. 7, the preferred embodiment of the invention includes a safety proximity switch mechanism 184 used to determine if the body 18 and the chamber head 20 of the chamber have been closed. A switch arm 186 extends from the shuttle 134 and includes a sensed surface 188. A proximity switch 190 is mounted on a switch support 192 such that the switch 190 is activated by sensing the surface 188 when the chamber head 20 is closed against the body 18. The switch 190 then sends a signal to the control and readout unit 42, indicating that the chamber is closed. The controller is also programmed such that the microwave power cannot be operated if a vacuum is present. In the preferred embodiment, a drying process cannot begin if the chamber is open.

The particular configuration of the preferred embodiment of the agitators paddles is disclosed in FIGS. 8, 9 and 10. In the preferred embodiment, the arm 150 of each paddle 58 is affixed around the shaft 60. Each blade 152 is affixed to the end of the arm 150, opposite the shaft. Each blade is curved, with the concave portion of the curve pointing away from the arm 150. Each blade 152 also has a pointed end 194. The point is sharp enough to ease passage through the powdered or particulate material, but not so sharp that the blade will damage large, soft particulate product.

The shaft rotates clockwise as viewed in FIG. 10, so that the point 194 is in the direction of paddle rotation. As best illustrated in FIG. 10, the blade width, measured in the radial direction from the shaft 60, is small near the pointed end 194 and expands to a maximum where the blade 152 contacts the arm 150. The curved configuration of the blade 152 acts to gently lift powdered or particulate material during agitation. However, the point 194 is not excessively sharp; together with the lesser radial width of the blade 152, it serves to minimize damage to product during agitation, especially large, soft particulate food items.

Referring now FIGS. 11 and 12, the mechanism for removal of the shaft 60 and the paddles 58 from the product container 24 is disclosed. The latch plug 164 includes an arcuate tongue 196 extending outward from the axis of the shaft 60. The tongue 196 mates with the radial groove 198 formed between a plug bracket 200 and the inner bulkhead 120. The radial groove 198 has an opening 202 slightly larger than the arcuate tongue 196. The latch plug 164 can then be removed from the product container 24 by manually rotating the plug until the tongue 196 has moved in the radial groove 198 such that the tongue is entirely within the opening 202. To ease that rotation, the latch plug 164 has a knob 204.

FIG. 11 also illustrates the respective positions of the lower flanges 122 on the inner bulkhead 120. In the preferred embodiment, the lower flanges 122 act as supports for the product container 24, by resting against the surface of the inner shell 124. Also as illustrated in FIG. 11, the inner bulkhead 120 is configured to fit loosely at all four of its corners against the surface of the inner shell 124.

FIGS. 13 and 14 illustrate the mounting of the product container 24 on the chamber head 20. The radial tongue 160 has an arcuate segment 206 that fits within the groove 158 of the mounting bracket 156. The radially tongue 160 is affixed to the forward bulkhead 148.

Rotation of the product container 24 for dumping of product is accomplished by rotating the filled container. The rotation moves the arcuate segment 206 from the approximate 8 o'clock position (with respect to the shaft 60) to a dumping position at approximately 4 o'clock. The product container can be fully removed from the mounting bracket 156 by rotating the container further such that the arcuate segment 206 corresponds to an opening 208 in the mounting bracket. Of course, rotation of the shaft 60 can if not restricted by the shaft opening 210. However, a close fit exists between the shaft 60 and the shaft opening 210 to prevent product leakage through the shaft opening. Ease of movement is primarily effected by the nature of the materials used for both the radial tongue 160 and shaft 60, and by the smooth surface on both the shaft and the inside of the shaft opening 210.

An alternative product container and drive mechanism for that container is illustrated in FIGS. 15 and 16. The alternative embodiment employs a tray 212 inside the drying chamber 10 to hold the product. In the illustrated embodiment, the tray 212 is circular. However, any configuration is appropriate so long as it will hold the product.

The tray embodiment of the product container is driven by a drive motor separate from the normal drive motor 28. In the preferred embodiment of the invention, the condensate drain 66 is removable from the drying chamber 10. The tray 212 can then be rotated about a tray shaft 214 that extends vertically through the drain connector 216. A tray drive motor 218 is then connected through a linkage 220 to the tray shaft 214. The tray drive motor 218 is supported by a motor bracket 222 mounted on the rail 132. In the preferred embodiment, the linkage 220 is a pulley system; however, any linkage that can impart a rotating drive to tray shaft 14 is appropriate.

As best illustrated by FIG. 16, the tray 212 has a rim 224. Product may be placed directly onto the tray 212, if desired, by spreading the product on a tray surface up to the height of the rim. Alternatively, product may be placed in a separate container, with that container placed on the tray 212. Like the product container 24, the tray 212 is composed of a relatively microwave transparent material, preferably polypropylene. Use of the arrangement of FIGS. 15 and 16 is especially appropriate for preliminary testing of a product to determine appropriate drying parameters.

The preferred embodiment of the mechanism of this invention may utilize either the tray 212 as product container, or a trough product container. In both instances, the drive motor imparts a rotation, and is controlled by the electronics of the control and read out unit 42.

The mechanism of the invention is also adapted for use with a clean-in-place system. As illustrated in FIG. 17, the clean-in-place system uses internal elements that spray water on both the product container and the surface of the inner shell 124.

In the preferred embodiment, the clean-in-place system includes a spray bar 226 inserted through the port 138. The spray bar 226 is connected to a water source from which water can be pumped into the drying chamber 10. The spray bar 226 cannot by itself, however, clean all of the components of the product container 24. The preferred embodiment therefore includes a spray ball 228 positioned beneath the product container. The spray ball is inserted through the drain connector 216,

after the drain 66 has been removed. In the preferred embodiment, drainage will still occur through the drain connector 216. Operation of the clean-in-place system is best accomplished with the product container 24 rotated to the fully inverted position so that water (or solvent) from the spray ball 228 can be sprayed into the interior of the product container 24. The clean-in-place system can also operate with the drive motor 28 turning the agitation system, so that each of the paddles 58 will be cleaned by the spray from the spray ball 228.

The procedure for using the mechanism of the preferred embodiment of the invention, and particularly the standard trough type product container, begins by filling the product container with product to the center line of the agitation system; that is, to shaft 60. The container is then closed with an effective seal between the chamber head 20 and the main body 18. The chiller, microwave generator, vacuum pump, and water heater are then turned on to allow each to "warm" up. Vacuum pump 40 is then started with large valve 96 open, and a vacuum is pulled in the chamber. In most drying operations, the vacuum is pulled until the pressure in the drying chamber is between ten and thirty-five torr. When the vacuum is at the desired level, the large valve 96 is closed, and the control system, if desired, then opens and closes the small valve 98 as necessary to maintain the vacuum in the drying chamber. Microwave power is then allowed to flow through the wave guide 30 into the drying chamber. The drive motor is activated, and the product is agitated in the presence of the vacuum and the microwave field until drying has been completed. The microwave power is then stopped, small valve 98 is closed, and back-to-atmosphere valve 64 is opened to allow air through the vent 62 into the drying chamber 10. The product can then be unloaded by opening the chamber head 20 and rotating the product container 24 to dump the now-dried product. The process can be repeated as many times as is desired.

In the preferred embodiment of the invention, the mechanism is adapted so that the sequence of drying can either be manually controlled or automatically controlled. Thus, the preferred embodiment of the invention includes automatic controls that can engage the entire start-up sequence, including opening and closing valves as necessary, activating microwave power, halting the drying operation, venting the drying chamber and opening the chamber through operation of the air cylinder 70. Alternatively, each of those acts can be conducted manually.

The controls employed and the alternatives available through use of those controls are best illustrated by reference to FIG. 18. In the preferred embodiment of the mechanism of the invention, the system is governed by a microcomputer 230. The microcomputer is of a conventional configuration, having a microprocessor 232 and internal clock 234. In the preferred embodiment of the invention, the program for the microprocessor can be external, or contained in an EPROM (Erasable Programmable Read Only Memory). The microcomputer has such other components as are necessary to its functioning.

Control of the drying process is accomplished through two basic systems, a control unit 238 and a series of sensors 240. The sensors include chamber field strength sensor 78, product temperature sensor 74, chamber pressure sensor 76, and water jacket temperature sensor 55. The system is configured to prevent operation of the air cylinder and thus opening of the

chamber if a vacuum is present. Additionally, the safety switch mechanism 184 acts as a chamber "open" sensor. Drying cannot begin if the chamber is open. The microwave generator 12 is of a conventional design that includes microwave power sensors 242 that measure both forward power directed into the drying chamber 10, and reflected power returned from drying chamber to the microwave generator.

The control unit 238 primarily comprises a series of controls 244 and indicators 246. The control unit 238 contains the elements of the control and read out unit 42 (which can be considered to be a remote push-button station), although some of its electronic components are contained in the electric components cabinet 44.

In the preferred embodiment of the invention, eight different parameters are indicated on the control and read out unit: elapsed drying time, chamber pressure, product temperature, chamber field strength, jacket temperature, microwave generator ready (indicating that the generator system is warmed up) forward microwave power, and reflected microwave power. In the preferred embodiment, indicators for each of those are contained on the control and read out unit 42. Of those indicators, all except the forward power and reflected power indicators are processed through the microcomputer. Forward power and reflected power are sent directly from the power sensors 242 in the microwave generator 12.

Control of the process of drying the product may be accomplished either through microcomputer operation of automatic cycles, or through manual operation of the system and human monitoring of the indicators. Thus, the controls include manual controls 248 and automatic cycle controls 250. All automatic cycle controls are operated by the microcomputer.

The manual controls begin with the governing controls 252: "system enable" and "power on". The system enable control is, preferably, a key operated switch that must be set to the proper position before any electronic or electromechanical components of the invention can be operated. The "power on" control simply turns on and activates the other controls on the remote push button station.

Manual operation of the system can occur through operation of 10 different manual controls. Manually, the chamber can be opened through the chamber door control, which activates air cylinder 70. The manual operation controls also include vacuum pump activation, a control for opening vacuum line valve 96, a control for opening the back-to-atmosphere vent 62 through operation of remote control valve 64, a generator electrical power on-off control ("generator warm up"), a control for microwave field activation ("microwave power on/off"), an agitator paddle activation control, a drive motor speed control, and a control for tray motor activation. Additionally, the manual operator controls include an emergency stop switch that shuts down all electrical power to all electromechanical elements in the system. The emergency stop switch operates to shut down all power when used in either the manual or automatic modes.

When automatic control of the drying process is accomplished, the preferred embodiment of the mechanism is programable to selectively halt the drying process upon the occurrence of any of a number of different events. To begin with, the system can be programmed to halt drying upon passage of a preset elapsed time. Alternatively, the microcomputer can be programmed to

halt drying upon achieving a particular product temperature. This feature is especially useful, since product temperature will begin a sudden increase when solvent vaporization has been nearly completed. As a further alternative, the system can be programmed to halt the drying operation upon sensor detection of a particular microwave field strength. This feature reflects a characteristic of microwaves, in that microwaves are primarily absorbed by the solvent. When the solvent has been fully vaporized and withdrawn by the vacuum system from the drying chamber, fewer microwaves will be absorbed, and the field strength within the chamber will increase. Thus, an increase in microwave field strength is an indicator of completion of the drying process.

In addition to halting the drying process upon achieving particular parameters, the system can also be set to maintain either chamber pressure, product temperature, or microwave field strength at predetermined levels. Thus, the operator determines the operating pressure and sets that pressure on the control and read out unit. The operator can also set a chosen product temperature, and the system can adjust to maintain that temperature throughout the operation. Finally, the system can be set to maintain a particular microwave field strength at a value to be chosen by the operator, throughout the entire drying operation.

In the preferred embodiment, the microcomputer is programmed and the controls are configured so that field strength and product temperature can be either maintained at preset levels, used as a stopping point for the drying operation, or not made any part of the automatic control. Chamber pressure can be either maintained at a particular level or not made part of the automatic control. Finally, the elapsed time setting need not be used, but the automatic system can function without stopping after a preset elapsed time. The microcomputer is programmed such that if multiple parameters are chosen as halting points for the drying process, drying will be stopped upon reaching the first of those parameters. Thus, for example, the system can be set so that a particular elapsed time is chosen for halting the process, and the process is set to halt upon reaching a particular product temperature, and the process is further set to halt upon reaching a chamber particular field strength. The drying process will then stop when any of those preset parameters are reached. Of course, any combination of elapsed time, temperature, or field strength, or in none of those parameters, can be selected as part of the automatic process.

As best illustrated in FIG. 18, the preferred embodiment of the mechanism includes thirteen different cycle controls. First, the controls include a timer allowing a particular drying time to be set. The controls also include a "timer enable" that switches the automatic cycle from a timed system to a "not timed" system. Similarly, the cycle controls include a pressure setting ("pressure set point adjustment"), and a "pressure control enable" that allows the cycle control to either maintain the set pressure, or not consider pressure to be any part of the control of the cycle.

Product temperature may also be set at an operator desired level. The controls include a temperature control selection that allows the preset temperature to either be a temperature maintained by the microcomputer throughout the drying process ("temperature set point"), or a temperature that the microcomputer will use a stopping point ("cycle completion"). Similarly, microwave field strength can be preset, and the controls

include both a field strength setting ("field strength set point"), and a field strength control selection that allows field strength to be either be the process stopping point ("cycle complete") or a particular level to be maintained throughout the drying process.

The cycle controls further include a switch that enables the automatic control system, i.e., the microprocessor ("sequence start and/off") and a switch that starts the automatic cycle, including the start up cycle ("start"). The controls also include a switch that moves the automatic controls to standby disabling the parameters that are controlling the automatic cycle ("standby/-day"), and a shutdown cycle control, which moves the mechanism through the full cycle from an operation made, to zero field strength, vented to atmospheric pressure, and with the chamber lip open.

Finally, as best illustrated in FIG. 18, the microcomputer will not only receive input from the controls, indicators, and sensors, the microcomputer will control all of the electromechanical devices as well, including the condenser unit 82, the vacuum pump 40 the remote operated valves 36, the back-to-atmosphere valve 64, and the water heater 32.

Although both preferred and alternative embodiments of the present invention have been set forth in the above detailed description, it is to be understood that the invention is limited only by the following claims and their equivalents.

What is claimed is:

1. A mechanism for batch drying of a powdered or particulate product, comprising, in combination:

- a chamber for drying the product;
- a container for the product, rotatably mounted in the chamber to allow dumping thereof;
- means for introducing microwaves into the chamber;
- means for producing a vacuum in the chamber;
- agitation means for agitating the product in the container during drying, said agitation means including a plurality of paddles rotating about a shaft within the container; and
- means for controlling the product's drying.

2. A mechanism as claimed in claim 1, wherein the product container has an open top and can be rotated while mounted in the chamber to position the container with its top down for product dumping.

3. A mechanism as claimed in claim 1, wherein the product container is removable from the chamber.

4. A mechanism as claimed in claim 1, wherein the means for producing a vacuum also can remove solvent vapor from the chamber.

5. A mechanism as claimed in claim 4, wherein the mechanism further comprises a condenser for solvent vapor that is removed from the chamber.

6. A mechanism as claimed in claim 5, wherein the mechanism further comprises a sealed condensate receiver adapted to receive condensed solvent from the condenser.

7. A mechanism as claimed in claim 1, wherein the chamber comprises:

- a body having a heating jacket to prevent solvent condensation on the chamber's inner surface; and
- a chamber head, with the chamber head adapted to move on a rail away from the body, and further adapted to use the heating system of the body to prevent condensation of the chamber head's inner surface.

8. A mechanism as claimed in claim 7, wherein the heating jacket operates by placing hot water around the chamber.

9. A mechanism as claimed in claim 7, wherein the product container is removably attached to the chamber head, and is removed from the chamber body by moving the chamber head on the rail away from the chamber body.

10. A mechanism as claimed in claim 9, wherein the product container is rotatable on the chamber head for removal of the product from the container.

11. A mechanism as claimed in claim 10, wherein the chamber is elongated about a longitudinal axis, the chamber head comprises a segment of the chamber at one end of the axis, and the product container rotates about the axis.

12. A mechanism as claimed in claim 11, wherein the container can be removed from the chamber head by further rotation of the container.

13. A mechanism as claimed in claim 1, wherein the chamber includes a clean-in-place system.

14. A mechanism as claimed in claim 13, wherein the clean-in-place system comprises:
one or more sources of solvent spray; and
a solvent drain.

15. A product container for use in a microwave vacuum drying mechanism, comprising, in combination:
a basin with an open top;
agitation means for agitating product within the basin, including a plurality of paddles rotating about a shaft within the product container; and
attachment means for attaching the basin inside the microwave drying mechanism, the attachment means being adapted to allow the basin to rotate for product dumping such that the open top is directed downwardly.

16. A product container as claimed in claim 15, wherein each paddle comprises:
an arm mounted on the shaft at one end; and
a blade mounted on the arm's opposite end, with the blade configured as an inverted scoop having a concave side and a convex side, with the concave side positioned toward the surface of the container, and with the blade further configured with a point on the rotationally forward side of the blade.

17. A product container as claimed in claim 15, wherein the paddles and shaft may be removed from the product container.

18. A drying chamber for a microwave vacuum drying mechanism adapted for batch drying and capable of holding a product container, the mechanism including a structure adapted to rotationally agitate the product being dried, the chamber comprising, in combination:

- a shell internally reflective of microwaves;
- a removable chamber head that mates with the shell at a joint;
- a heating jacket surrounding the shell and chamber head, and separable into two parts at the joint between the shell and chamber head;
- a conductive, flexible seal at the joint between the shell and the chamber head;
- a drive motor mounted on the chamber head, the motor being adapted to drive the agitation structure;
- a first support for the product container, the support being mounted within the chamber;
- a second support for the chamber head when the chamber head is both open and closed.

19. A chamber as claimed in claim 18, further comprising an air cylinder to move the chamber head on the rail upon command from a remote control unit.

20. A chamber as claimed in claim 19, further comprising a sensor indicating lack of a seal between the shell and chamber head.

21. A chamber as claimed in claim 20, wherein the support for the product container is mounted on the chamber head, and the drive motor drives the agitation structure by a shaft running through the support.

22. A chamber as claimed in claim 21, wherein the support for the chamber head comprises:

- a rail;
- a shuttle attached to the chamber head and mounted on the rail, the shuttle having one or more rollers adapted to roll on opposite sides of the rail, the shuttle further having a platform to support the drive motor.

23. A chamber as claimed in claim 22, wherein the shell further comprises a drain having a removable valve.

24. A chamber as claimed in claim 22, wherein the product container can be replaced with a product tray having a shaft, with the shaft extending through the drain with the valve removed, and the shaft is rotationally driven by a second drive motor mounted on the exterior of the chamber.

25. A mechanism for batch drying of powdered or particulate product through combined application of a microwave field and a vacuum to the product, the mechanism having a source of microwave radiation and vacuum producing structure, the mechanism comprising, in combination:

- a drying chamber in which the vacuum and microwave field are applied to the product, the chamber having a microwave reflective interior and removable chamber head;
- a product container integrally mounted on the chamber head such that removal of the chamber head extracts the container from the chamber, with the product container being rotatable for product dumping and relatively transparent to microwave radiation;
- an agitation mechanism integrally mounted to the product container and configured to move product within the product container during microwave vacuum drying, the agitation mechanism being relatively transparent to microwave radiation; and
- a drive system for the agitation mechanism, the drive system being external to the chamber.

26. A mechanism for batch drying of powdered or particulate product as claimed in claim 24, wherein the product container is configured as a trough, open at its top, and adapted to be supported during rotation by both the chamber head and the interior of the product chamber.

27. A mechanism for batch drying of powdered or particulate product as claimed in claim 24, wherein the container is removably attached to a mounting bracket affixed to the chamber head, with the mounting bracket configured to allow product dumping after rotation of the container a first distance about the mounting bracket, and removal of the container from the mounting bracket after rotation of the container a second distance about the mounting bracket.

28. A mechanism for batch drying of powdered or particulate product as claimed in claim 26, wherein the agitation mechanism is supported by the mounting

bracket, and removal of the product container from the mounting bracket also removes the agitation mechanism from the mounting bracket.

29. A mechanism for batch drying of powdered or particulate product as claimed in claim 27, wherein the agitation mechanism comprises:

a shaft extending through the product container through the mounting bracket, and supported at one end by the mounting bracket and at the remaining end by the container, with the shaft being rotatable about its longitudinal axis;

a plurality of mixing arms attached at one end to the shaft and adapted to rotate about the shaft's axis when the shaft rotates, each arm having a blade attached to arm at the end opposite the shaft.

30. A mechanism for batch drying of powdered or particulate product as claimed in claim 24, wherein the drying chamber includes a heating jacket, and the jacket applies heat to both the chamber and the chamber head.

31. A mechanism for batch drying of powdered or particulate product as claimed in claim 24, wherein the chamber includes a remote operated vent to allow the chamber to return to atmospheric pressure after drying.

32. A mechanism for batch drying of powdered or particulate product as claimed in claim 24, further comprising a solvent recovery system to recover solvent vapor for reuse.

33. A mechanism for batch drying of powdered or particulate product as claimed in claim 31 wherein the solvent recovery system comprises:

a vacuum pump that draws solvent vapor from the chamber;

a condenser that returns the removed solvent vapor to the liquid phase; and

a sealed condensate reservoir that holds the condensed vapor for subsequent reuse.

34. A mechanism for batch drying of powdered or particulate product as claimed in claim 24, wherein the chamber's head is mounted for rolling movement on a rail, and movement is effected by a remote operated air cylinder.

35. A mechanism for batch drying of powdered or particulate product as claimed in claim 34, wherein the drive system is a motor mount on the chamber head and configured to move with the chamber head on the rail.

36. A mechanism for batch drying of powdered or particulate product as claimed in claim 24, further comprising:

means for sensing temperature or microwave field strength in the chamber; and

means for halting a drying operation upon reaching a predetermined chamber temperature or microwave field strength.

37. A mechanism for batch drying of powdered or particulate product as claimed in claim 35, further comprising means for maintaining the chamber pressure constant during the drying operation.

38. A mechanism for batch drying of powdered or particulate product as claimed in claim 35, further comprising means for halting a drying operation after a predetermined elapsed time.

39. A mechanism for batch drying of powdered or particulate product as claimed in claim 35, further comprising means for maintaining the chamber temperature or chamber field strength constant during a drying operation.

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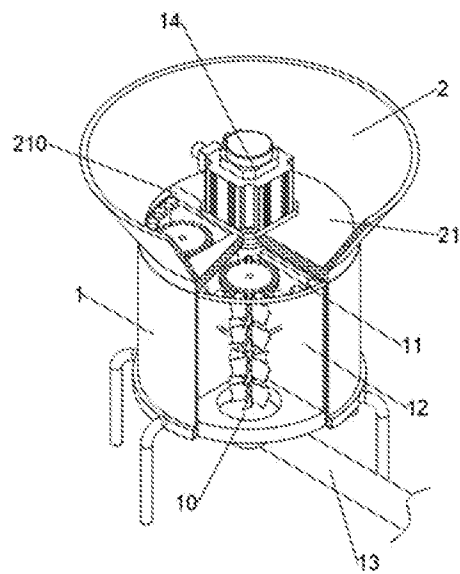
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(54) 实用新型名称
一种糯米粉加工的气流干燥器

(57) 摘要

本实用新型涉及糯米粉加工技术领域,具体地说,涉及一种糯米粉加工的气流干燥器。其包括干燥箱,所述干燥箱顶部设有进料斗,所述进料斗靠近所述干燥箱顶部处设有底板,所述底板表面开设有通孔,所述干燥箱内部转动设有转筒,所述转筒外壁设有多个挡板,多个所述挡板将干燥箱内部等分为多个空间,且等分的空间通过通孔与进料斗连通,所述转筒外壁等间距开设有多个气孔,多个所述气孔分别与多个所述挡板等分的空间连通。本实用新型一方面对进入干燥箱内的糯米粉进行搅拌,另一方面将投入的糯米粉分布在多个挡板等分干燥箱的多个空间,使热气从气孔排入空间内对糯米粉干燥效果更佳,提高均匀度。



1. 一种糯米粉加工的气流干燥器,包括干燥箱(1),其特征在于:所述干燥箱(1)顶部设有进料斗(2),所述进料斗(2)靠近所述干燥箱(1)顶部处设有底板(21),所述底板(21)表面开设有通孔(210),所述干燥箱(1)内部转动设有转筒(11),所述转筒(11)外壁设有多个挡板(12),多个所述挡板(12)将干燥箱(1)内部等分为多个空间,且等分的空间通过通孔(210)与进料斗(2)连通,所述转筒(11)外壁等间距开设有多个气孔(110),多个所述气孔(110)分别与多个所述挡板(12)等分的空间连通。

2. 根据权利要求1所述的糯米粉加工的气流干燥器,其特征在于:所述进料斗(2)内部固定设有电机(14),所述电机(14)输出轴贯穿所述底板(21)表面连接所述转筒(11)顶部。

3. 根据权利要求1所述的糯米粉加工的气流干燥器,其特征在于:所述转筒(11)端部转动穿出所述干燥箱(1)内部,且所述转筒(11)端部转动连通有气管(13)。

4. 根据权利要求1所述的糯米粉加工的气流干燥器,其特征在于:所述干燥箱(1)底部连通设有出料斗(10),所述出料斗(10)顶部边缘处与所述挡板(12)底部贴合。

5. 根据权利要求1所述的糯米粉加工的气流干燥器,其特征在于:两个所述挡板(12)之间设有转杆(15),所述转杆(15)通过支架转动位于两个所述挡板(12)之间,所述转杆(15)外壁设有多个扰板(151)。

6. 根据权利要求5所述的糯米粉加工的气流干燥器,其特征在于:所述进料斗(2)底部嵌设有内凸轮盘(22),所述转杆(15)端部连接有联动齿轮(152),所述联动齿轮(152)外壁与所述内凸轮盘(22)内壁啮合。

一种糯米粉加工的气流干燥器

技术领域

[0001] 本实用新型涉及糯米粉加工技术领域,具体地说,涉及一种糯米粉加工的气流干燥器。

背景技术

[0002] 糯米粉是用糯米浸泡一夜,水磨打成浆水,用个布袋装着吊一个晚上,待水滴干了,把湿的糯米粉团掰碎晾干后就是成品的糯米粉,为了加快糯米粉的干燥需要借助气流干燥器,用于干燥在潮湿状态时仍能在气体中自由流动的颗粒物料,但是目前的气流干燥器在干燥糯米粉时将大量的糯米粉聚集在干燥箱内,造成糯米粉堆积较多,尽管进行搅拌烘干,覆盖的糯米粉不能均匀接触热气,导致干燥效率慢,鉴于此,我们提出一种糯米粉加工的气流干燥器。

实用新型内容

[0003] 本实用新型的目的在于提供一种糯米粉加工的气流干燥器,以解决上述背景技术中提出的问题。

[0004] 为实现上述目的,本实用新型提供一种糯米粉加工的气流干燥器,包括干燥箱,所述干燥箱顶部设有进料斗,所述进料斗靠近所述干燥箱顶部处设有底板,所述底板表面开设有通孔,所述干燥箱内部转动设有转筒,所述转筒外壁设有多个挡板,多个所述挡板将干燥箱内部等分为多个空间,且等分的空间通过通孔与进料斗连通,所述转筒外壁等间距开设有多个气孔,多个所述气孔分别与多个所述挡板等分的空间连通。

[0005] 本实用新型在具体使用时,将干燥箱支撑在地面上,从进料斗投放潮湿的糯米粉,同时,转筒带动挡板转动,使挡板等分的干燥箱空间依次与通孔连通,使糯米粉均匀的掉落至干燥箱的不同空间,减小糯米粉的堆积,且随着挡板的转动,对糯米粉进行搅拌,使从转筒进入的热气经过气孔对两个挡板之间的糯米粉进行气流式干燥。

[0006] 作为本技术方案的进一步改进,所述进料斗内部固定设有电机,所述电机输出轴贯穿所述底板表面连接所述转筒顶部。

[0007] 作为本技术方案的进一步改进,所述转筒端部转动穿出所述干燥箱内部,且所述转筒端部转动连通有气管。

[0008] 作为本技术方案的进一步改进,所述干燥箱底部连通设有出料斗,所述出料斗顶部边缘处与所述挡板底部贴合。

[0009] 作为本技术方案的进一步改进,两个所述挡板之间设有转杆,所述转杆通过支架转动位于两个所述挡板之间,所述转杆外壁设有多个扰板。

[0010] 作为本技术方案的进一步改进,所述进料斗底部嵌设有内凸轮盘,所述转杆端部连接有联动齿轮,所述联动齿轮外壁与所述内凸轮盘内壁啮合。

[0011] 与现有技术相比,本实用新型的有益效果:

[0012] 该糯米粉加工的气流干燥器中,通过糯米粉从进料斗投放到干燥箱内部,随着转

筒带动挡板转动,一方面对进入干燥箱内的糯米粉进行搅拌,另一方面将投入的糯米粉分布在多个挡板等分干燥箱的多个空间,使热气从气孔排入空间内对糯米粉干燥效果更佳,提高均匀度。

附图说明

- [0013] 图1为本实用新型实施例1的整体结构示意图;
[0014] 图2为本实用新型实施例1的整体结构剖切图;
[0015] 图3为本实用新型实施例1的干燥箱结构剖切图;
[0016] 图4为本实用新型实施例1的挡板结构示意图;
[0017] 图5为本实用新型实施例1的进料斗结构示意图;
[0018] 图6为本实用新型实施例1的转杆结构示意图。
[0019] 图中各个标号意义为:
[0020] 1、干燥箱;10、出料斗;11、转筒;110、气孔;12、挡板;13、气管;14、电机;15、转杆;151、扰板;152、联动齿轮;
[0021] 2、进料斗;21、底板;210、通孔;22、内凸轮盘。

具体实施方式

[0022] 下面将结合本实用新型实施例中的附图,对本实用新型实施例中的技术方案进行清楚、完整地描述,显然,所描述的实施例仅仅是本实用新型一部分实施例,而不是全部的实施例。基于本实用新型中的实施例,本领域普通技术人员在没有做出创造性劳动前提下所获得的所有其他实施例,都属于本实用新型保护的范围。

[0023] 实施例

[0024] 请参阅图1-图6所示,本实施例提供一种糯米粉加工的气流干燥器,包括干燥箱1,干燥箱1顶部设有进料斗2,进料斗2靠近干燥箱1顶部处设有底板21,底板21表面开设有通孔210,干燥箱1内部转动设有转筒11,转筒11外壁设有多个挡板12,多个挡板12将干燥箱1内部等分为多个空间,且等分的空间通过通孔210与进料斗2连通,转筒11外壁等间距开设有多个气孔110,多个气孔110分别与多个挡板12等分的空间连通,考虑到将大量的糯米粉聚集在干燥箱1内,造成糯米粉堆积较多,干燥效果差,因此,为了提高干燥效率,通过糯米粉从进料斗2投放到干燥箱1内部,随着转筒11带动挡板12转动,一方面对进入干燥箱1内的糯米粉进行搅拌,另一方面将投入的糯米粉分布在多个挡板12等分干燥箱1的多个空间,使热气从气孔110排入空间内对糯米粉干燥效果更佳,提高均匀度。

[0025] 本实用新型在具体使用时,将干燥箱1支撑在地面上,从进料斗2投放潮湿的糯米粉,同时,转筒11带动挡板12转动,使挡板12等分的干燥箱1空间依次与通孔210连通,使糯米粉均匀的掉落至干燥箱1的不同空间,减小糯米粉的堆积,且随着挡板12的转动,对糯米粉进行搅拌,使从转筒11进入的热气经过气孔110对两个挡板12之间的糯米粉进行气流式干燥。

[0026] 为了提高转筒11转动的自动化程度,进料斗2内部固定设有电机14,电机14输出轴贯穿底板21表面连接转筒11顶部,将电机14接通电源,使其工作,由电机14输出轴带动转筒11转动更便捷,提高自动化程度。

[0027] 为了保证热气的传输功能,转筒11端部转动穿出干燥箱1内部,且转筒11端部转动连通有气管13,可以由气管13接通热气泵,将电热网的热气经过气管13传输到转筒11内部,使热气可以从气孔110排入干燥箱1内部,保证干燥的基本功能。

[0028] 为了方便收集干燥后的糯米粉,干燥箱1底部连通设有出料斗10,出料斗10顶部边缘处与挡板12底部贴合,可以实现干燥后的糯米粉从出料斗10排出,方便收集糯米粉,于此同时,在挡板12转动时,可以对出料斗10和干燥箱1顶部连接处进行刮动,提高排料效果。

[0029] 考虑到搅拌效率低,因此,为了进一步提高搅拌效果,两个挡板12之间设有转杆15,转杆15通过支架转动位于两个挡板12之间,转杆15外壁设有多个扰板151,通过转杆15转动,带动扰板151转动,对两个挡板12之间的糯米粉再次搅拌,提高搅拌效果,使热气更均匀的烘干潮湿糯米粉。

[0030] 为了提高联动效果,进料斗2底部嵌设有内凸轮盘22,转杆15端部连接有联动齿轮152,联动齿轮152外壁与内凸轮盘22内壁啮合,可以在挡板12转动时,使联动齿轮152外壁沿着内凸轮盘22转动移动,从而使挡板12转动同时带动转杆15转动,实现对糯米粉进行双重搅拌,提高干燥均匀度。

[0031] 本实用新型糯米粉加工的气流干燥器在具体使用时,从进料斗2顶部开口处投放潮湿的糯米粉,由气管13接通热气泵,将电热网的热气经过气管13传输到转筒11内部,使热气可以从气孔110排入干燥箱1内部,同时,由电机14输出轴带动转筒11转动,转筒11带动挡板12转动,使挡板12等分的干燥箱1空间依次与通孔210连通,使糯米粉均匀的掉落至干燥箱1的不同空间,减小糯米粉的堆积,且随着挡板12的转动,对糯米粉进行搅拌,使从转筒11进入的热气经过气孔110对两个挡板12之间的糯米粉进行气流式干燥,干燥后的糯米粉从出料斗10排出,于此同时,在挡板12转动时,使联动齿轮152外壁沿着内凸轮盘22转动移动,从而使挡板12转动同时带动转杆15转动,通过转杆15转动带动扰板151转动,对两个挡板12之间的糯米粉再次搅拌,实现对糯米粉进行双重搅拌。

[0032] 以上显示和描述了本实用新型的基本原理、主要特征和本实用新型的优点。本行业的技术人员应该了解,本实用新型不受上述实施例的限制,上述实施例和说明书中描述的仅为本实用新型的优选例,并不用来限制本实用新型,在不脱离本实用新型精神和范围的前提下,本实用新型还会有各种变化和改进,这些变化和改进都落入要求保护的本实用新型范围内。本实用新型要求保护范围由所附的权利要求书及其等效物界定。

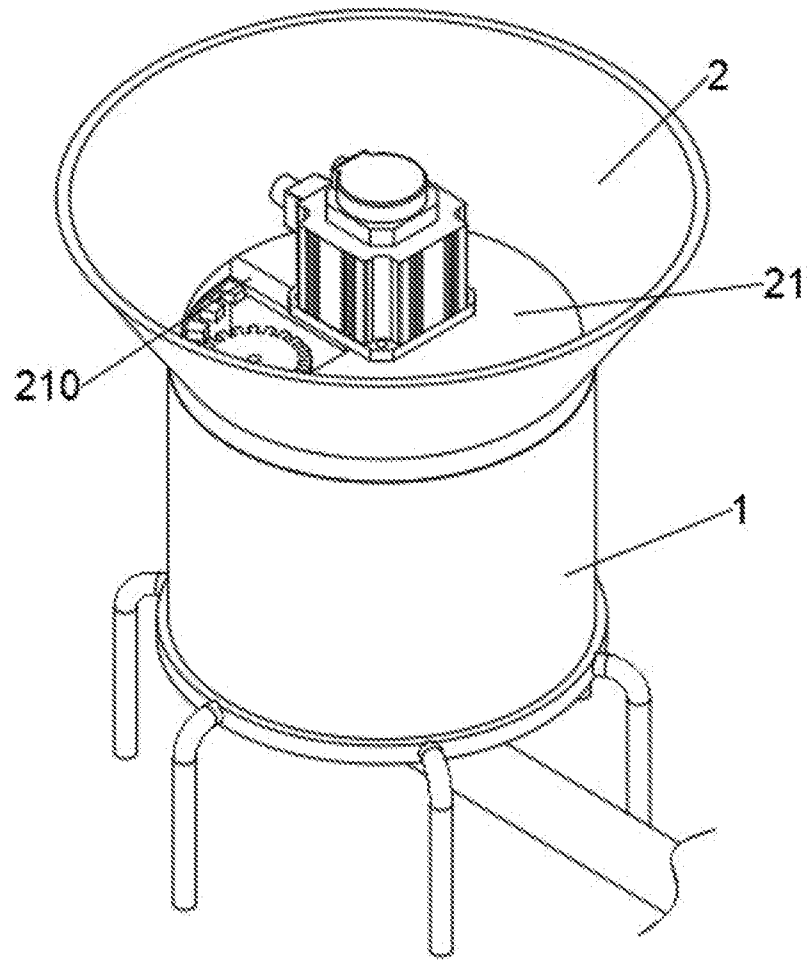


图1

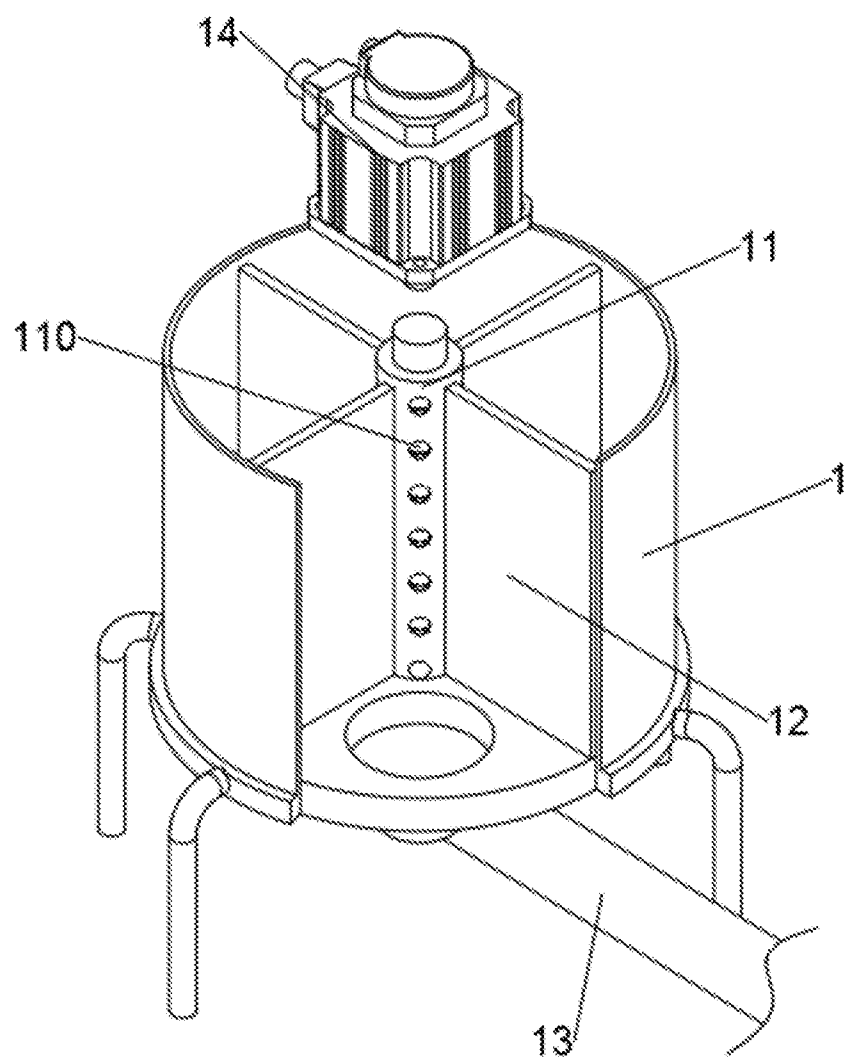


图3

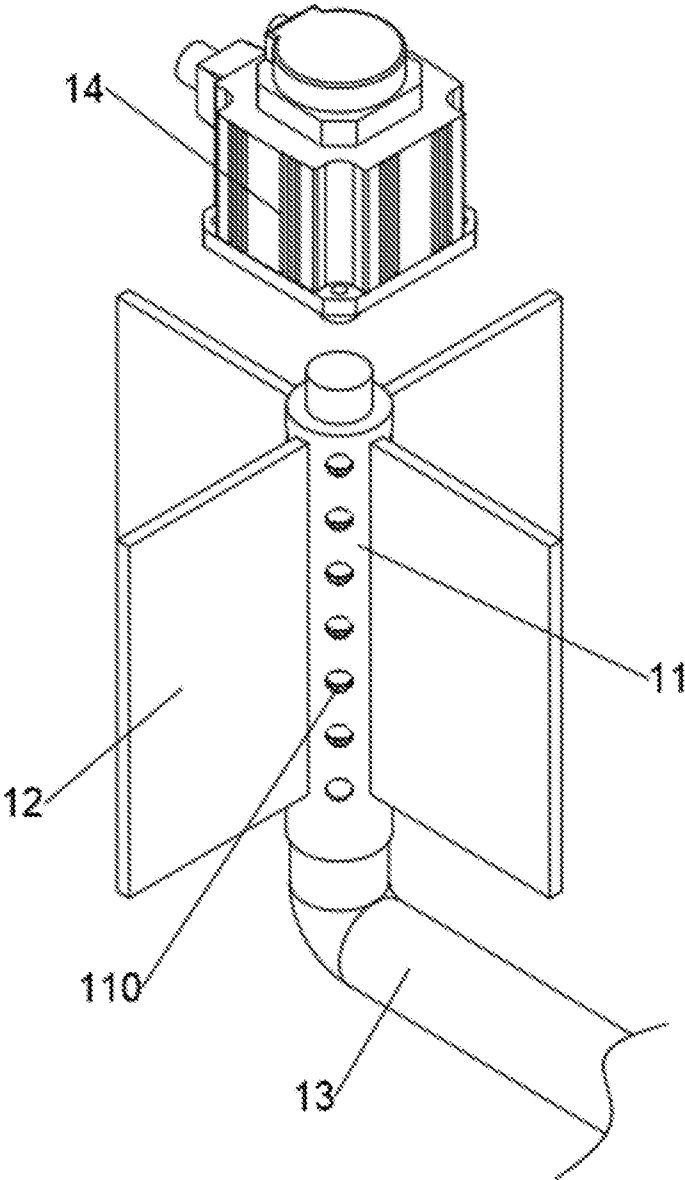


图4

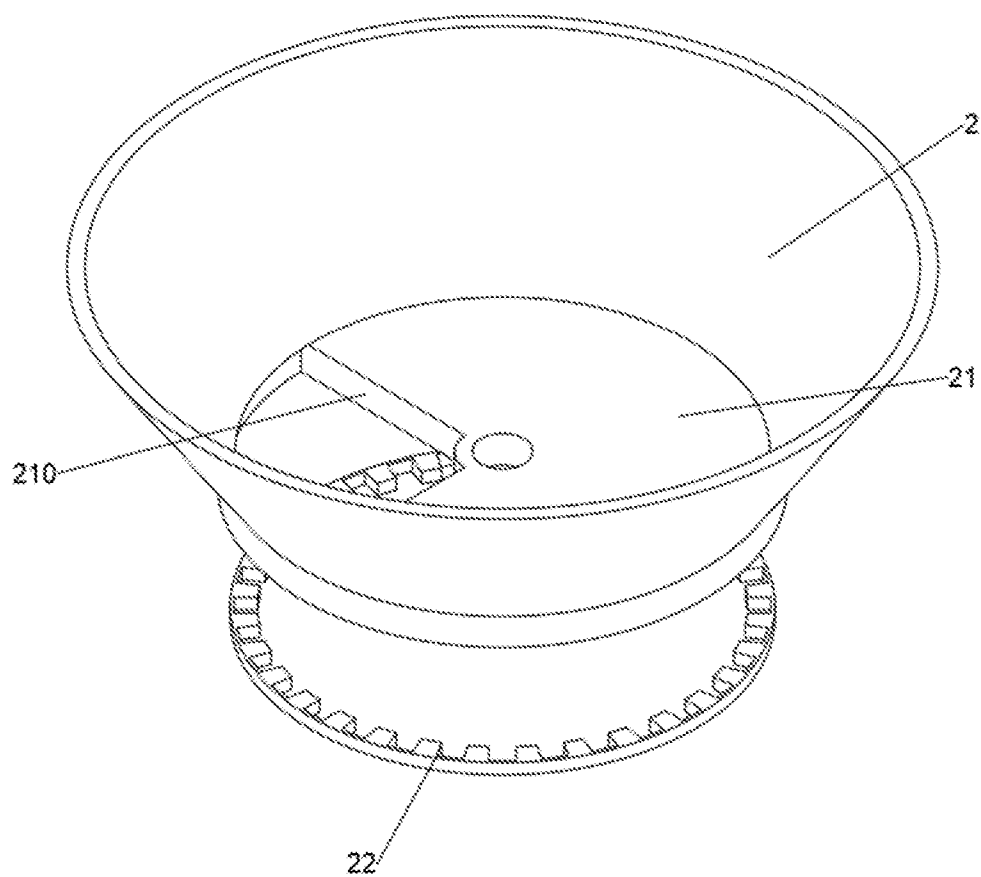


图5

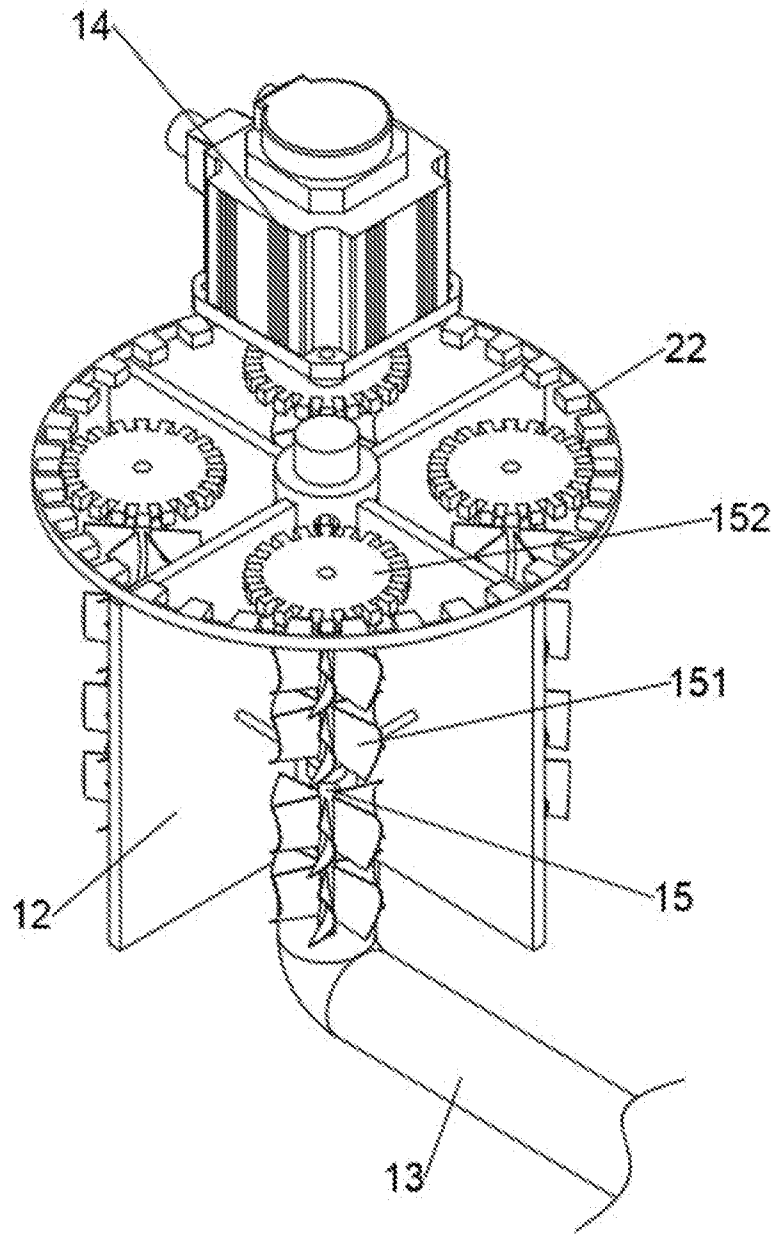


图6



ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

(12) ОПИСАНИЕ ИЗОБРЕТЕНИЯ К ПАТЕНТУ

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(54) ДВУХСЕКЦИОННАЯ БАРАБАНАЯ СУШИЛКА

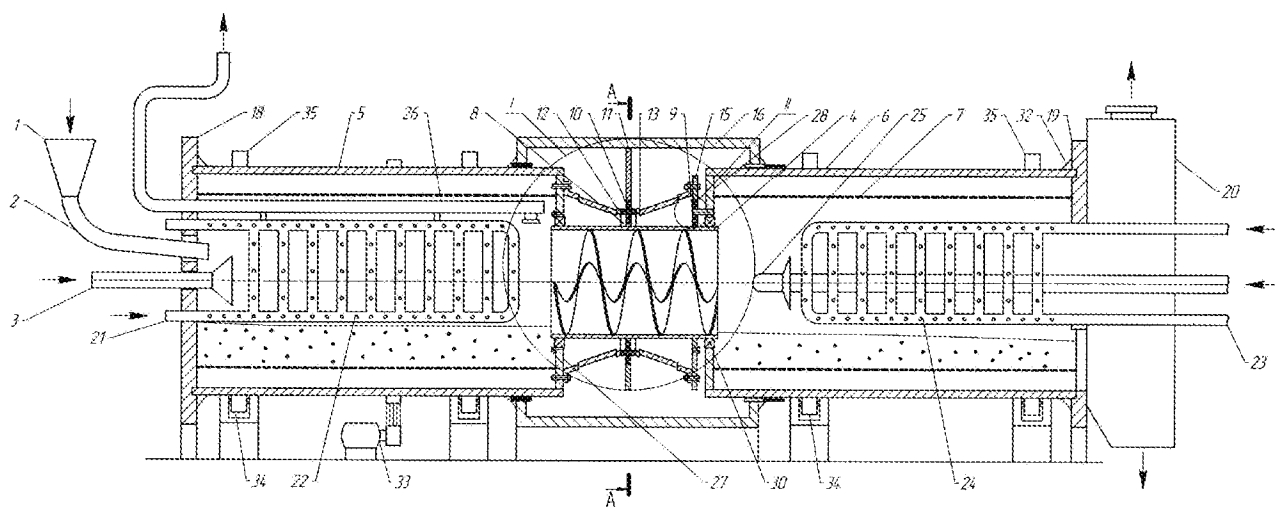
(57) Реферат:

Изобретение относится к сушильной технике и может быть использовано в пищевой и химической промышленности. Двухсекционная барабанная сушилка содержит загрузочное устройство, разгрузочную камеру, патрубок подвода теплоносителя, переливную диафрагму между секциями с возможностью автономного соосного вращения секций посредством замкнутой планетарной дифференциальной передачи. Новым является то, что каждая секция снабжена подъемно-лопастными насадками и плоским коллектором, размещенным по длине секций в вертикальной плоскости с отверстиями для подачи теплоносителя в поперечном направлении; между первой и второй секциями установлена промежуточная камера с соосно

расположенной в ней переливной диафрагмой, выполненной в виде шнека, корпус которого снабжен двумя жестко закрепленными зубчатыми бандажами и установлен в подшипниках, запрессованных в торцевые фланцы каждой секции; в промежуточной камере установлены промежуточный и ведомый ряды сателлитов, а также соосно с секциями размещены два полуконуса, один из которых большим основанием жестко закреплен к торцевому фланцу первой секции, а к большему основанию другого полуконуса посредством болтового соединения жестко закреплена шестерня с внутренними зубьями; при этом полуконусы малыми основаниями закреплены между собой через оси промежуточного ряда сателлитов, установленных

в подшипниках и взаимодействующих с другим зубчатым бандажом корпуса переливной диафрагмы и кольцом с внутренними зубьями, образующих внутреннюю зубчатую планетарную передачу. Двухсекционная барабанная сушилка

обеспечивает равномерность сушки материала при переменных режимах, позволяет повысить производительность и снизить энергозатраты на процесс сушки. 1 з.п. ф-лы, 7 ил.



Фиг. 1



FEDERAL SERVICE
FOR INTELLECTUAL PROPERTY

(19) **RU** (11)
(51) Int. Cl.
F26B 11/04 (2006.01)

2 767 423 ⁽¹³⁾ **C1**

(12) ABSTRACT OF INVENTION

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(54) TWO-SECTION DRUM DRYER

(57) Abstract:

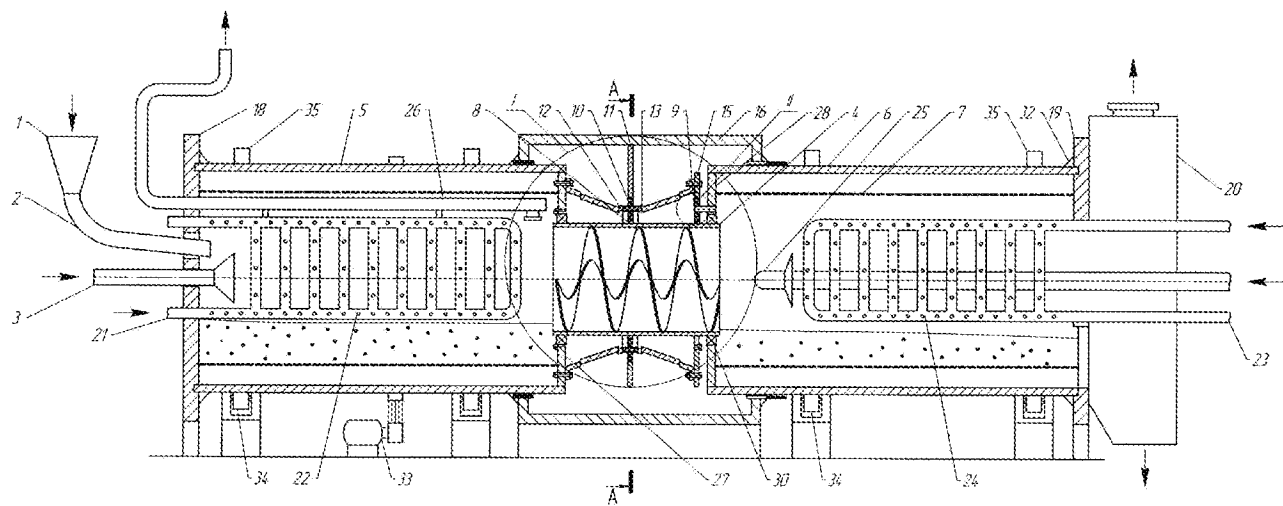
FIELD: drying machinery.

SUBSTANCE: invention relates to drying equipment and can be used in the food and chemical industry. The two-section drum dryer contains a loading device, an unloading chamber, a coolant supply pipe, an overflow diaphragm between the sections with the possibility of autonomous coaxial rotation of the sections by means of a closed planetary differential transmission. What is new is that each section is equipped with lifting-blade nozzles and a flat collector placed along the length of the sections in a vertical plane with holes for supplying coolant in the transverse direction; an intermediate chamber is installed between the first and second sections with an overflow diaphragm coaxially located in it, made in the form of a screw, the body of which is equipped with two rigidly fixed toothed rims and mounted in bearings pressed into the end flanges of each section; an intermediate

and driven rows of satellites are installed in the intermediate chamber, and two half-cones are placed coaxially with the sections, one of which is rigidly fixed to the end flange of the first section with a large base, and a gear with internal teeth is rigidly fixed to the larger base of the other half-cone by means of a bolted connection; at the same time, the semi-cones are fixed with small bases to each other through the axes of an intermediate row of satellites mounted in bearings and interacting with another gear rim of the overflow diaphragm housing and a ring with internal teeth forming an internal planetary gear.

EFFECT: two-section drum dryer ensures uniform drying of the material under variable conditions, makes it possible to increase productivity and reduce energy consumption for the drying process.

1 cl, 7 dwg



Фиг. 1

RU 2767423 C1

RU 2767423 C1

Изобретение относится к сушильной технике и может быть использовано в пищевой и химической промышленности.

Известна барабанная сушилка [Патент СССР. №1657907 от 16.01.1989, опубл. 23.06.1991] включающая первую секцию барабана, вторую секцию барабана, загрузочную воронку.

Известная сушилка не может обеспечить равномерную сушку дисперсного материала и не создает реальных перспектив для повышения производительности сушилки в широком диапазоне режимных параметров процесса сушки для различных материалов.

Наиболее близким по технической сущности и достигаемому эффекту является барабанная сушилка (Патент №2649379, от 27.06.2017, опубл. 02.04.2018, Бюл. №10), содержащая многосекционный барабан, замкнутую дифференциальную планетарную передачу, загрузочное устройство и разгрузочный бункер.

Недостатком данной сушилки является невозможность сбалансированной перегрузки материала между секциями, что не позволяет обеспечить рациональное распределение дисперсного материала по сушильному тракту и реализовать переменный режим процесса сушки с минимальными энергетическими затратами. Отсутствие возможности обеспечения необходимого расхода материала через переливные диафрагмы смежных секций для стабилизации текущей величины степени заполнения каждой секции дисперсным материалом не дает оснований считать режим сушки рациональным как с точки зрения получения качества высушенного материала, так и с точки зрения экономии энергетических затрат. В данной секционной сушилке замкнутая дифференциальная передача предусмотрена для соосного вращения секций сушилки от одного привода, однако не предусмотрено конструктивное решение переливной диафрагмы, способной увеличить расход перегружаемого материала относительно вращающихся секций барабанной сушилки и осуществлять ступенчатую сушку в оптимальных гидродинамических и температурных режимах.

Технической задачей изобретения является реализация переменных режимов сушки, обеспечивающих равномерность сушки и повышение качества высушиваемого материала, повышение производительности и снижение энергозатрат на процесс сушки.

Поставленная задача достигается тем, что двухсекционная барабанная сушилка, содержащая загрузочное устройство, разгрузочную камеру, патрубок подвода теплоносителя, переливную диафрагму между секциями с возможностью автономного соосного вращения секций посредством замкнутой планетарной дифференциальной передачи новым является то, что каждая секция снабжена подъемно-лопастными насадками и плоским коллектором, размещенным по длине секций в вертикальной плоскости с отверстиями для подачи теплоносителя в поперечном направлении; между первой и второй секциями установлена промежуточная камера с соосно расположенной в ней переливной диафрагмой, выполненной в виде шнека, корпус которого снабжен двумя жестко закрепленными зубчатыми бандажами и установлен в подшипниках, запрессованных в торцевые фланцы каждой секции; в промежуточной камере установлены промежуточный и ведомый ряд сателлитов, а также соосно с секциями размещены два полуконуса, один из которых большим основанием жестко закреплен к торцевому фланцу первой секции, а к большему основанию другого полуконуса посредством болтового соединения жестко закреплена шестерня с внутренними зубьями; на внутреннюю поверхность промежуточной камеры жестко посажено кольцо с внутренними зубьями; в торцевом фланце второй секции закреплены водила с установленными на них в подшипниках сателлитами ведомого ряда, взаимодействующими с одним из зубчатых бандажей переливной диафрагмы и шестерней

с внутренними зубьями, образующих дифференциальную планетарную внутреннюю зубчатую передачу; при этом полуконусы малыми основаниями закреплены между собой через оси промежуточного ряда сателлитов, установленных в подшипниках и взаимодействующих с другим зубчатым бандажом корпуса переливной диафрагмы и кольцом с внутренними зубьями, образующих внутреннюю зубчатую планетарную передачу; при этом в неподвижном фланце первой секции двухсекционной барабанной сушилки установлен патрубок загрузочного устройства и патрубок центрального подвода теплоносителя в плоские коллекторы; патрубок с центральным подводом теплоносителя во вторую секцию выполнен в виде раструба, подача теплоносителя в который осуществляется по трубкам, проходящим через разгрузочную камеру; между неподвижными и торцевым фланцами первой секции установлена труба для вывода отработанного теплоносителя из первой секции.

На фиг. 1 схематически изображена двухсекционная барабанная сушилка, на фиг. 2 - увеличенное изображение I на фиг. 1, на фиг. 3 - общий вид двухсекционной барабанной сушилки, на фиг. 4 - увеличенное изображение II на фиг. 1, на фиг. 5 - разрез А-А на фиг. 1, на фиг. 6 - разрез Б-Б на фиг. 1, на фиг. 7 - разрез В-В на фиг. 1.

Двухсекционная барабанная сушилка содержит загрузочное устройство 1, соединенное с неподвижным фланцем первой секции 18, патрубок подвода высушиваемого материала 2, патрубок центрального подвода теплоносителя 3, переливную диафрагму 4, перегружающую продукт из первой секции барабана 5 во вторую секцию барабана 6, подъемно-лопастные насадки 7, первый зубчатый бандаж переливной диафрагмы 8, второй зубчатый бандаж переливной диафрагмы 9, промежуточный ряд сателлитов 10, кольцо с внутренними зубьями 11, левый полуконус 12, правый полуконус 13, ось 14, шестерня с внутренними зубьями 15, промежуточную камеру 16, ведомый ряд сателлитов 17, неподвижный фланец второй секции 19, разгрузочную камеру 20, патрубок подвода теплоносителя в плоский коллектор первой секции 21, плоский коллектор первой секции 22, патрубок подвода теплоносителя в плоский коллектор второй секции 23, плоский коллектор второй секции 24, раструб 25, трубу с патрубком для отвода теплоносителя 26, торцевой фланец первой секции 27, торцевой фланец второй секции 28, водило 29, подшипник 30, подшипник 31, уплотнительную манжету 32, привод 33, опорные ролики 34, бандаж барабанов 35.

Двухсекционная барабанная сушилка работает следующим образом.

Высушиваемый материал через загрузочное устройство 1 по патрубку 2 сначала поступает в первую секцию 5 барабанной сушилки, а затем через переливную диафрагму 4 во вторую секцию 6 барабанной сушилки, после чего выводится из сушилки через разгрузочную камеру 20.

Вращающиеся секции 5 и 6 своими бандажми 35 установлены на опорные ролики 34 и вместе с переливной диафрагмой 4 приводятся во вращение от общего привода 33.

Подъемно-лопастные насадки 7, расположенные на внутренней поверхности секций 5 и 6, обеспечивают равномерное перемешивание и перемещению высушиваемого материала по длине сушилки.

В процессе сушки осуществляют одновременную подачу теплоносителя в рабочий объем первой секции 5 через патрубок центрального подвода 3 и патрубок плоского коллектора 21, размещенного по длине секции в вертикальной плоскости. Через отверстия в плоском коллекторе 22 подают теплоноситель в поперечном направлении относительно движения пересыпающегося с помощью подъемно-лопастной насадки 7 слоя высушиваемого материала. При этом создаются условия равномерного

распределения потока теплоносителя через движущийся слой материала по всей длине первой секции барабанной сушилки. Отработанный теплоноситель выводят из первой секции через трубу 26, установленную в неподвижном фланце 18.

5 Подачу теплоносителя в плоский коллектор 24 второй секции 6 осуществляют через неподвижный фланец 19 и патрубок центрального подвода 23, с раструбом 25, в который теплоноситель подводят по трубкам, проходящим через разгрузочную камеру. Отработанный теплоноситель выводят из второй секции через отверстия в неподвижном фланце 19 и разгрузочную камеру 20.

10 Установленная между первой и второй секциями барабанной сушилки промежуточная камера 16 содержит соосно с ней расположенную переливную диафрагму 4, установленную в подшипниках 31, которые в свою очередь запрессованы в торцевом фланце 27 первой секции 5 и в торцевом фланце 28 второй секции 6. Переливная диафрагма 4 служит для перегрузки высушиваемого материала посредством шнека из первой секции 5 во вторую секцию 6.

15 Вращение секций и переливной диафрагмы осуществляется от одного привода и двух дифференциальных планетарных зубчатых передач, расположенных в промежуточной камере 16.

20 Первая дифференциальная планетарная внутренняя зубчатая передача образована первым зубчатым бандажом переливной диафрагмы 8, промежуточным рядом сателлитов 10, кольцом с внутренними зубьями 11 и соосно размещенными с секциями левым и правым полуконусами 12, 13.

25 Вторая внутренняя зубчатая планетарная передача образована вторым зубчатым бандажом переливной диафрагмы 9, шестерней с внутренними зубьями 16, жестко закрепленной посредством болтового соединения к большому основанию правого полуконуса 13, и подшипниковым узлом, состоящим из закрепленных водил 29 с установленным на них в подшипниках ведомым рядом сателлитов 17.

30 Привод 33 обеспечивает вращение первой секции барабана 5 находящегося в жесткой связи посредством болтового соединения с левым полуконусом 12, который в свою очередь передает вращение промежуточному ряду сателлитов 10 и правому полуконусу 13. Промежуточный ряд сателлитов 10, взаимодействующий посредством зубчатого зацепления с кольцом с внутренними зубьями 11 и первым зубчатым бандажом 8 приводит во вращение переливную диафрагму 4. Шестерня с внутренними зубьями 15 правого полуконуса 13 и второй зубчатый бандаж переливной диафрагмы 9, совершая вращательное движение, приводят во вращение ведомый ряд сателлитов 17, которые
35 через водила 29 приводят во вращение вторую секцию барабана 6.

Изменение передаточных чисел шестерни с внутренними зубьями 15 и ведомого ряда сателлитов 17 позволяет создать оптимальные условия перегрузки материала с заданной производительностью. При этом обеспечивается высокоэффективная сушка благодаря возможности изменения частот вращения смежных секций и переливной диафрагмы.

40 Непрерывность подачи, перемещения и перегрузки дисперсных материалов обеспечивается с учетом кинетических закономерностей процесса сушки определенных экспериментально. Для сбалансированной нагрузки секций необходимо изменять частоту вращения переливной диафрагмы. Чтобы увеличить количество перегружаемого материала изменяют диаметр промежуточного ряда сателлитов. Тогда при одинаковой
45 линейной скорости вращения переливной диафрагмы и сателлитов будет изменяться угловая скорость их вращения.

Возможность изменения частот вращения и их конструктивное оформление позволяет изменять характеристики планетарных передач и перенастраивать сушилку под

конкретный высушиваемый материал.

Таким образом, предлагаемая двухсекционная барабанная сушилка обеспечивает равномерность сушки материала при переменных режимах, позволяет повысить производительность и снизить энергозатраты на процесс сушки.

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(57) Формула изобретения

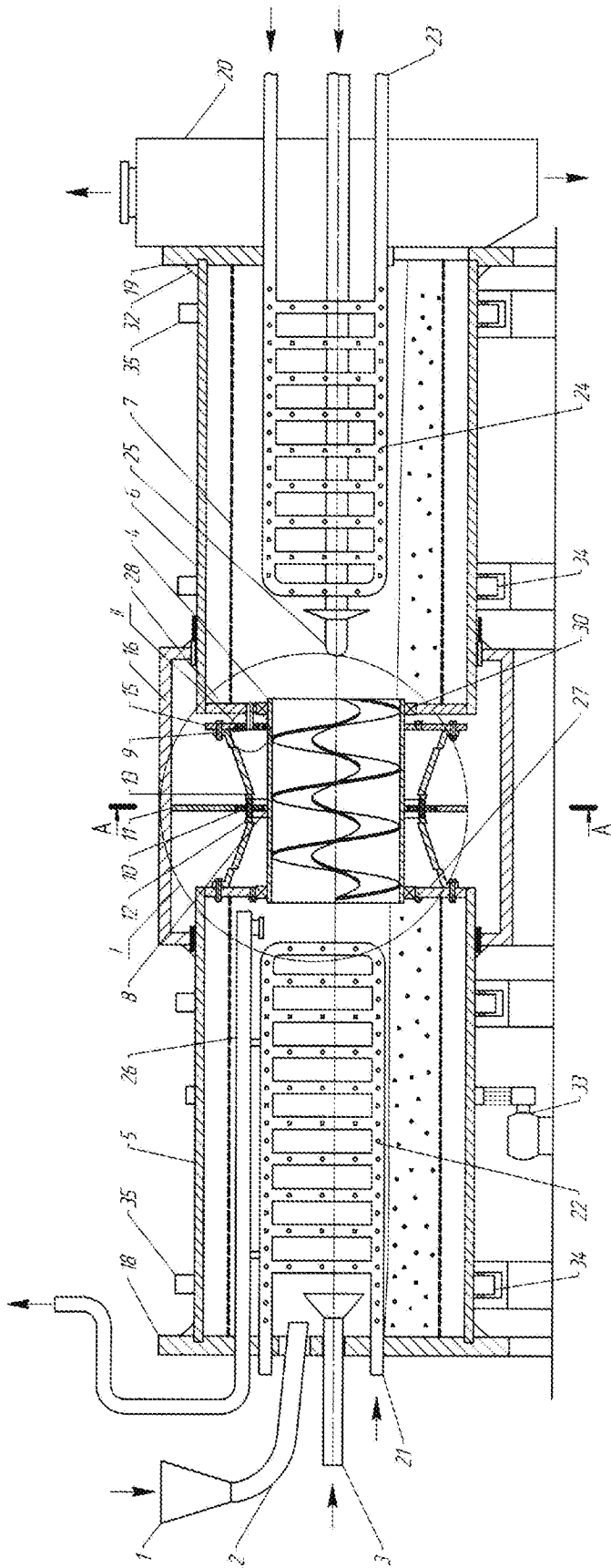
1. Двухсекционная барабанная сушилка, содержащая загрузочное устройство, разгрузочную камеру, патрубок подвода теплоносителя, переливную диафрагму между секциями с возможностью автономного соосного вращения секций посредством замкнутой планетарной дифференциальной передачи, отличающаяся тем, что каждая секция снабжена подъемно-лопастными насадками и плоским коллектором, размещенным по длине секций в вертикальной плоскости с отверстиями для подачи теплоносителя в поперечном направлении; между первой и второй секциями установлена промежуточная камера с соосно расположенной в ней переливной диафрагмой, выполненной в виде шнека, корпус которого снабжен двумя жестко закрепленными зубчатыми бандажами и установлен в подшипниках, запрессованных в торцевые фланцы каждой секции; в промежуточной камере установлены промежуточный и ведомый ряды сателлитов, а также соосно с секциями размещены два полуконуса, один из которых большим основанием жестко закреплен к торцевому фланцу первой секции, а к большему основанию другого полуконуса посредством болтового соединения жестко закреплена шестерня с внутренними зубьями; на внутреннюю поверхность промежуточной камеры жестко посажено кольцо с внутренними зубьями; в торцевом фланце второй секции закреплены водила с установленными на них в подшипниках сателлитами ведомого ряда, взаимодействующими с одним из зубчатых бандажей переливной диафрагмы и шестерней с внутренними зубьями, образующих дифференциальную планетарную внутреннюю зубчатую передачу; при этом полуконусы малыми основаниями закреплены между собой через оси промежуточного ряда сателлитов, установленных в подшипниках и взаимодействующих с другим зубчатым бандажом корпуса переливной диафрагмы и кольцом с внутренними зубьями, образующих внутреннюю зубчатую планетарную передачу.

2. Двухсекционная барабанная сушилка по п. 1, отличающаяся тем, что в неподвижном фланце первой секции установлен патрубок загрузочного устройства и патрубок центрального подвода теплоносителя в плоские коллекторы; патрубок с центральным подводом теплоносителя во вторую секцию выполнен в виде раструба, подача теплоносителя в который осуществляется по трубкам, проходящим через разгрузочную камеру; между неподвижными фланцами первой секции установлена труба для вывода отработанного теплоносителя из первой секции.

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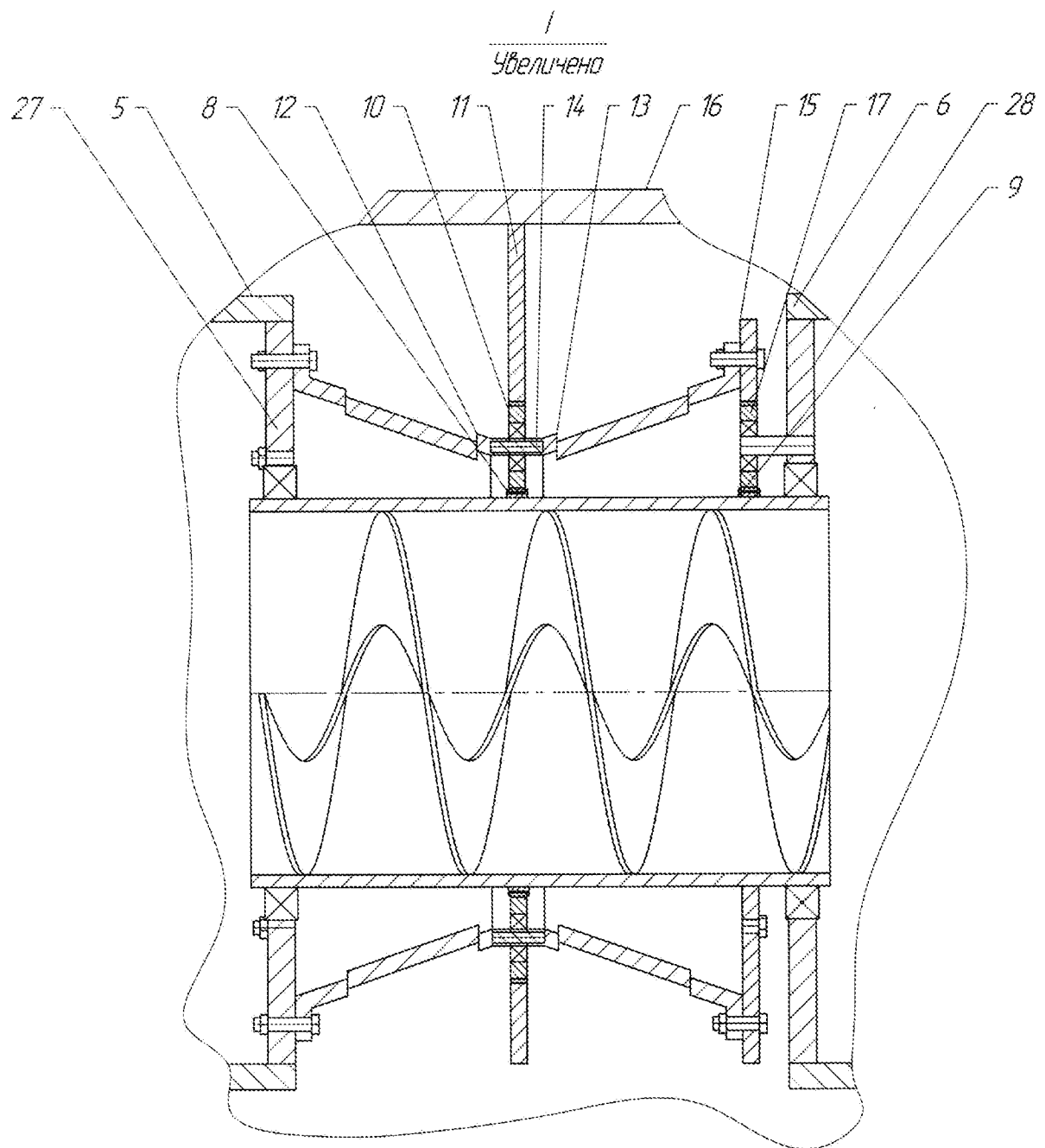
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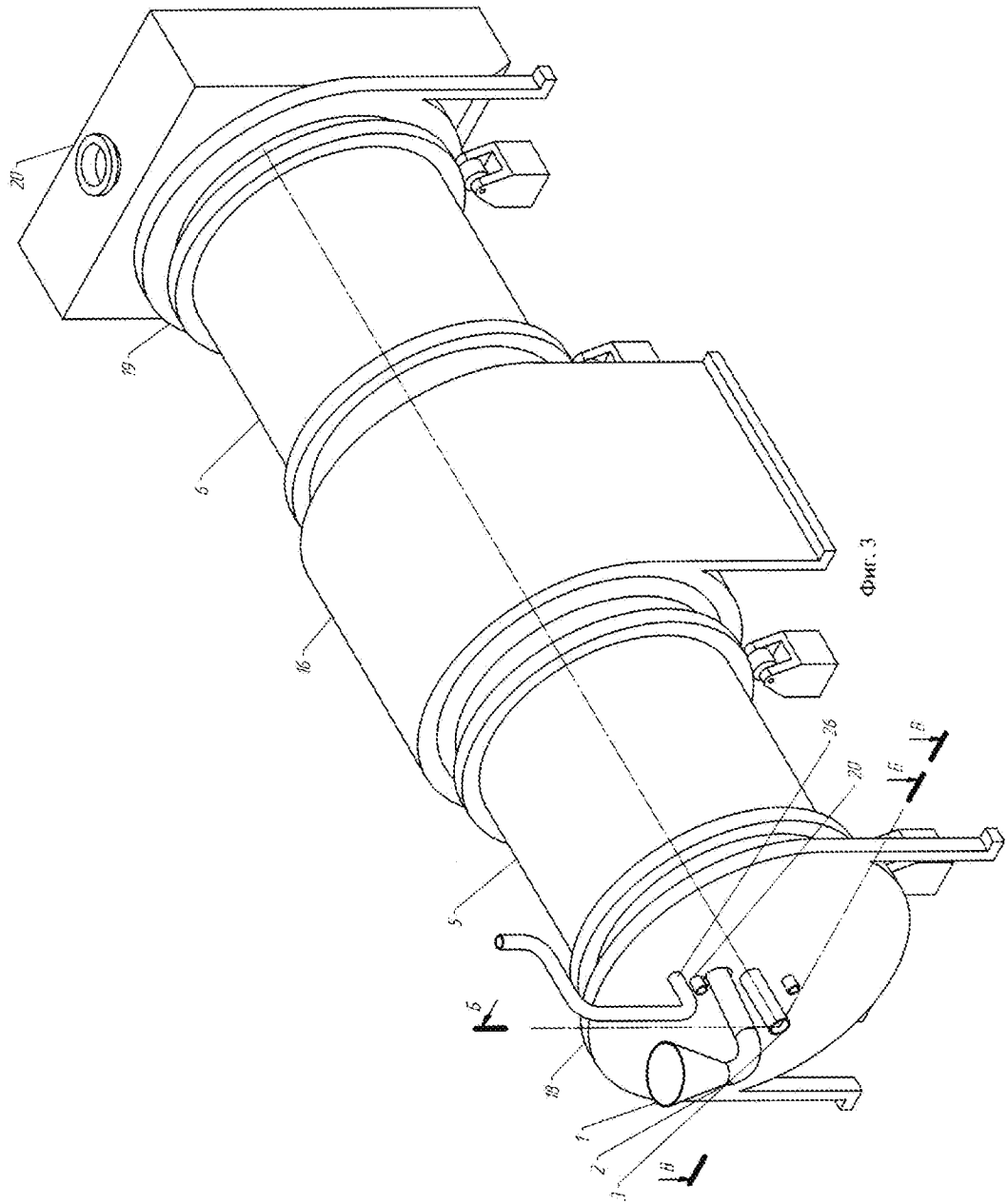


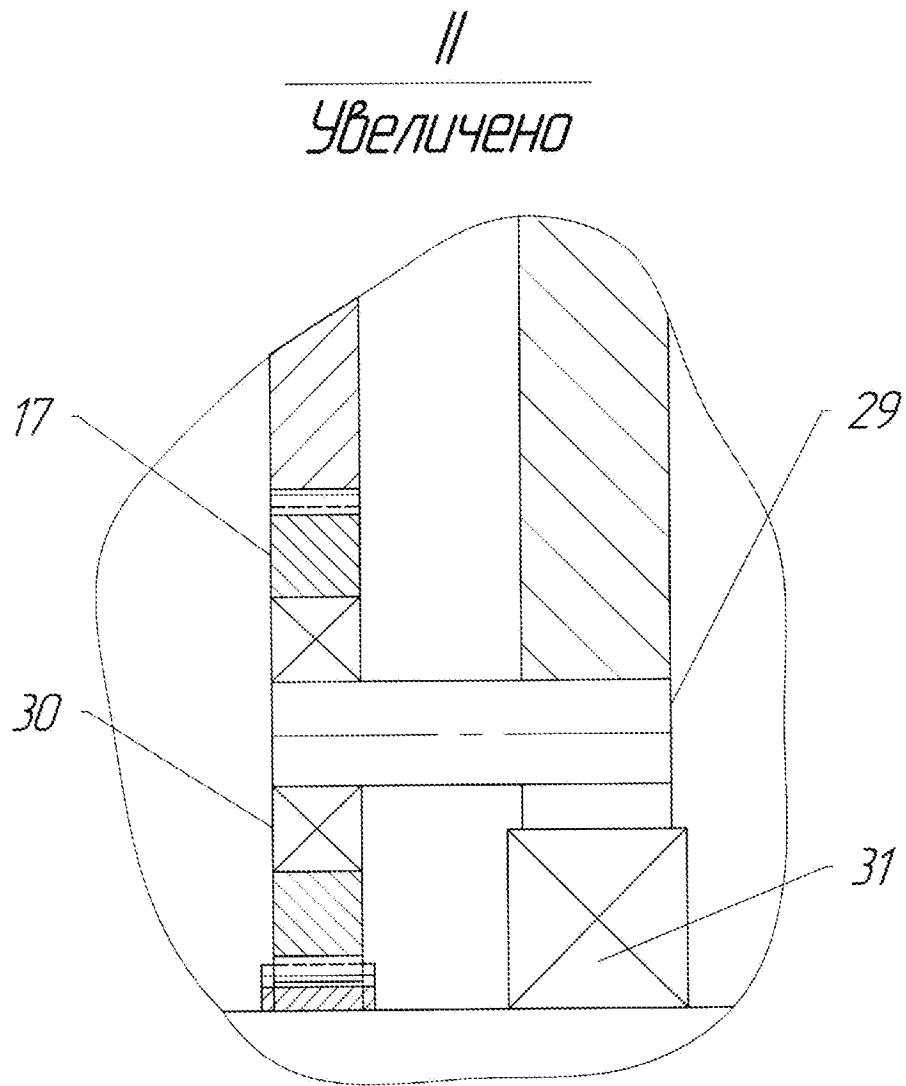
Фиг. 1

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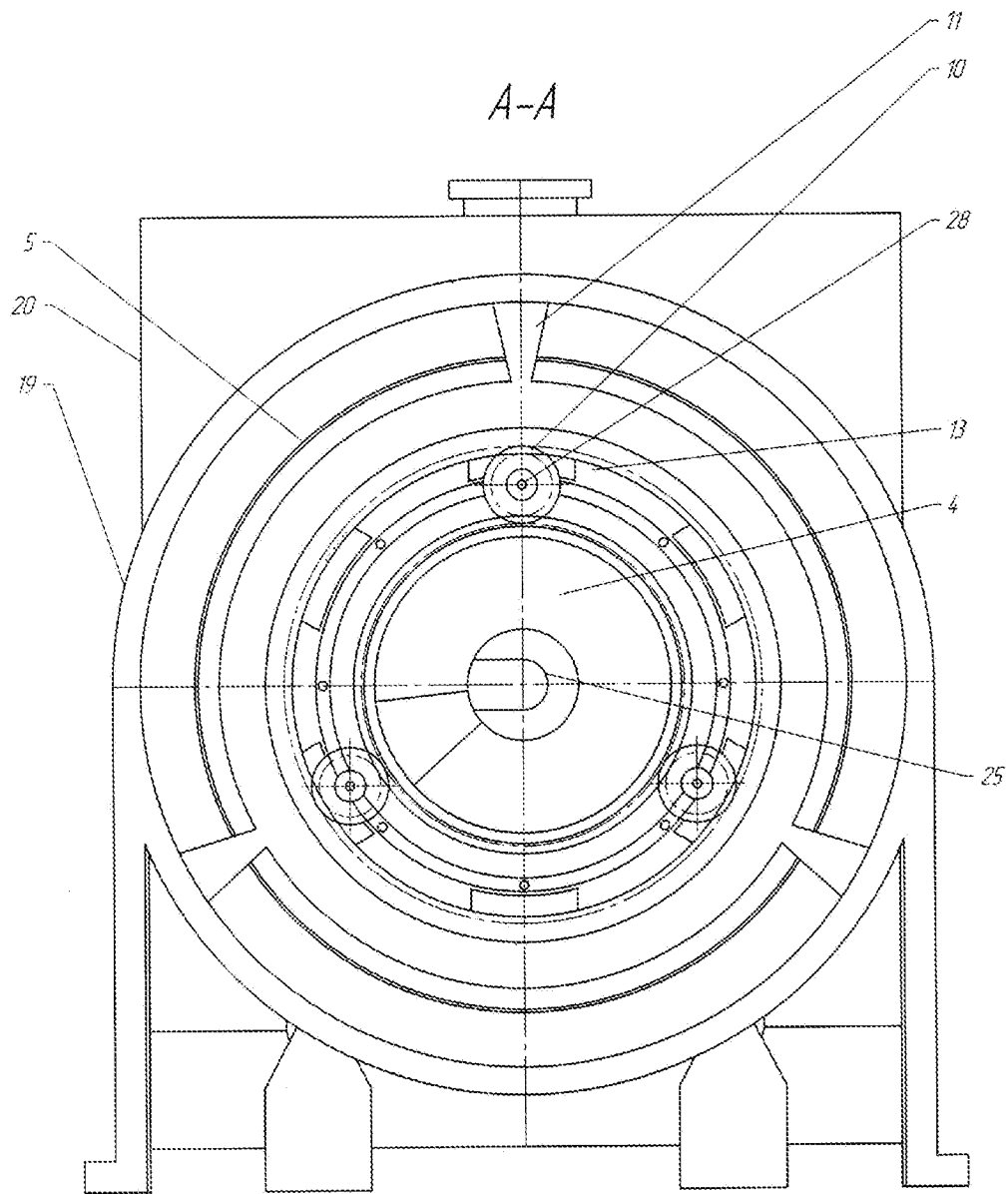


Фиг. 2

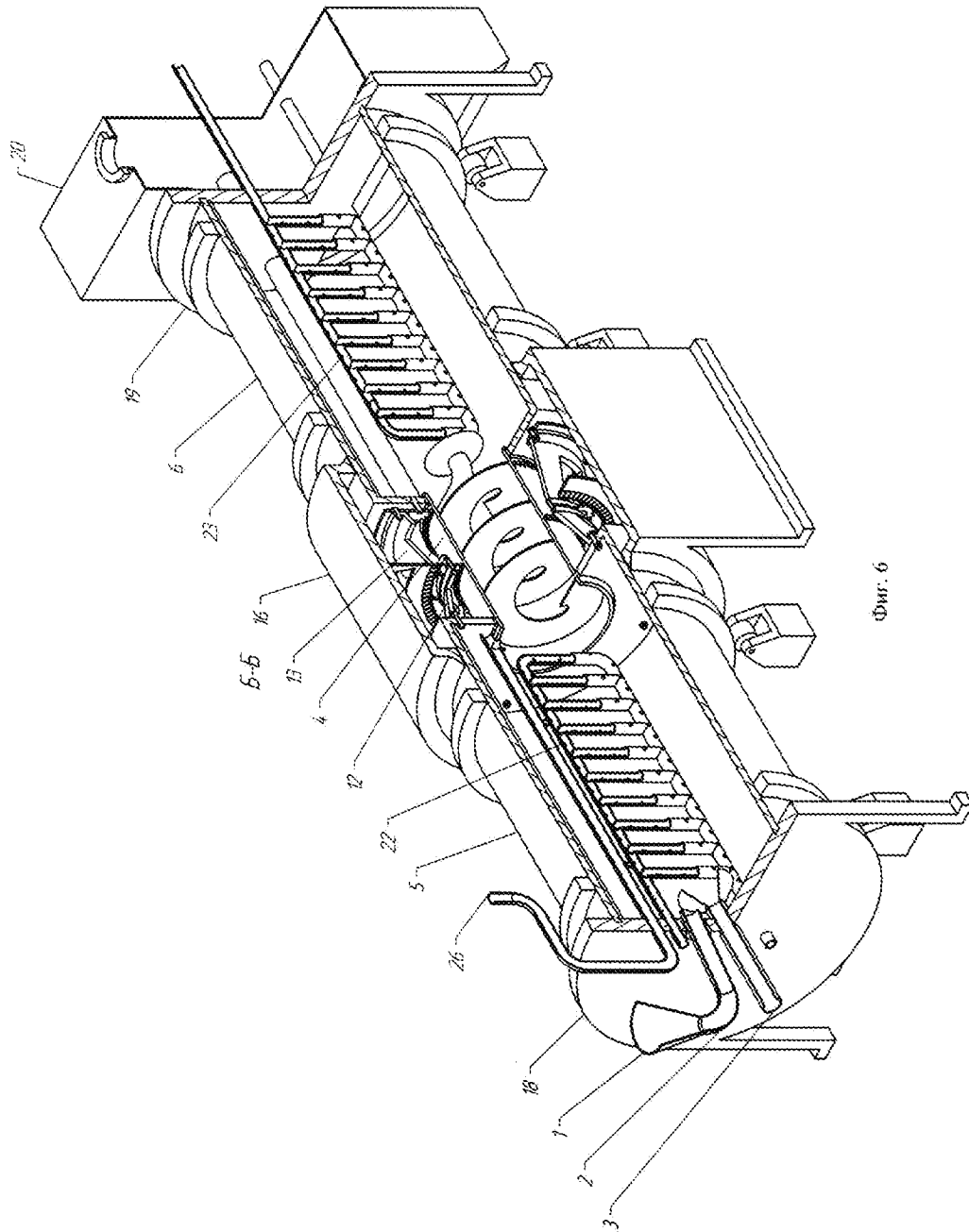




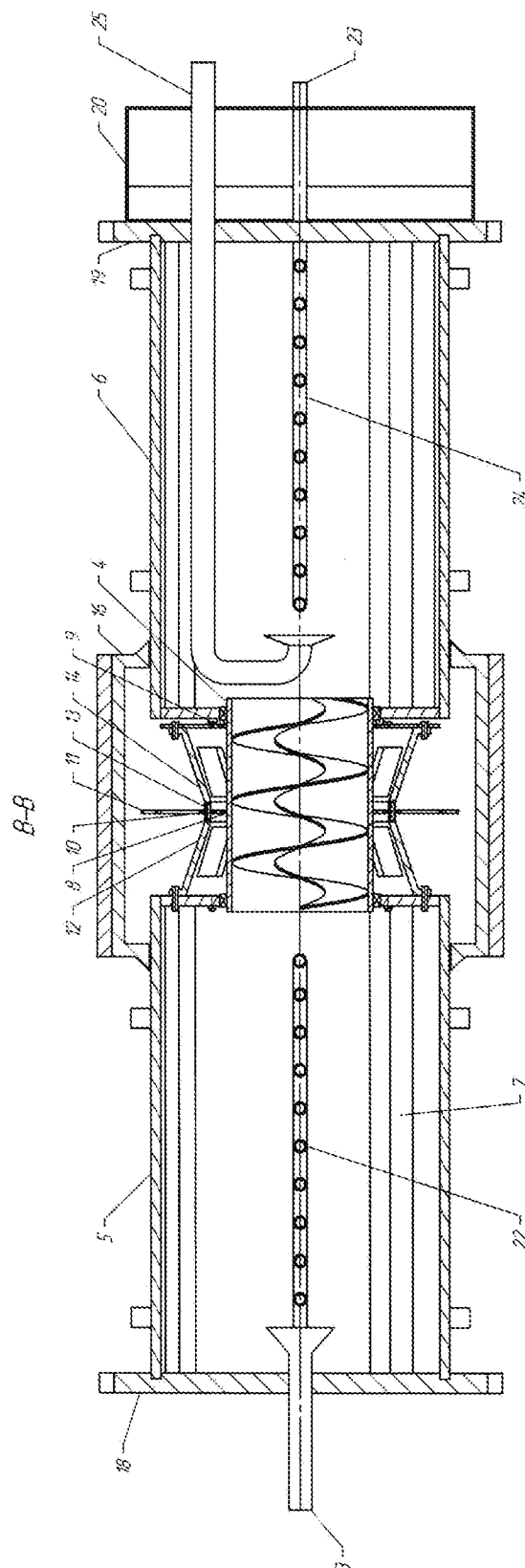
Фиг. 4



Фиг. 5



Фиг. 6



Фиг. 7



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(54) **Title:** DIELECTRIC DRYER DRUM

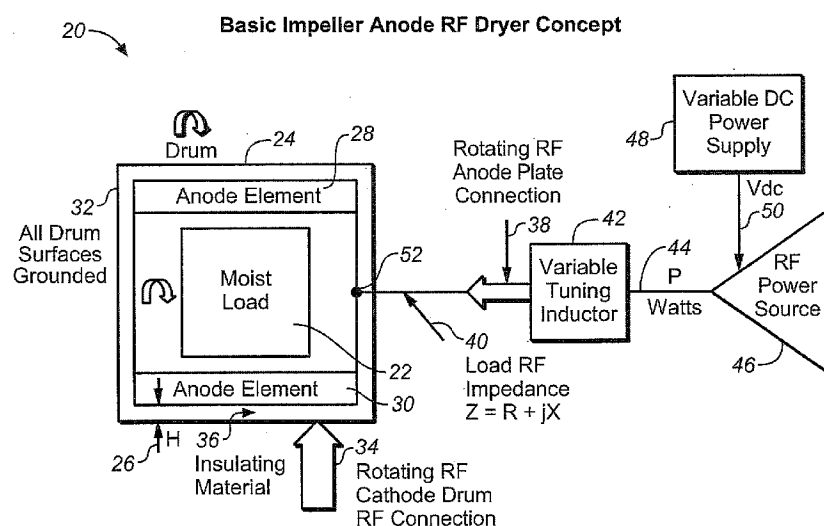


FIG. 2

(57) **Abstract:** Heating an object, (food, wet clothing) having a variable weight that includes a medium (water) comprising: placing the object having the variable weight including medium into an enclosure; initiating a heating process by subjecting object with medium to a variable AC electrical field; and controlling the heating process. The object/clothing having a first "cool" state and therefore includes a maximum weight in the first "cool" state due to absorption of medium. The object is substantially free from the medium/water in a second "heated" state due to substantial evaporation of the medium from the object. Heating process is completed when the object is substantially transitioned into the second "heated" state. The method further comprises using an air flow having an ambient temperature inside the enclosure to carry away the evaporated medium from the enclosure.

Description

DIELECTRIC DRYER DRUM

5 TECHNICAL FIELD

[0001] The technology relates to the field of Radio Frequency (RF) heating systems.

BACKGROUND

10 [0002] Conventional clothes dryers heat a large volume of air that then passes over tumbling clothes. Water is extracted from the wet clothes by evaporation into the heated air. This conventional drying process is extremely inefficient, as at least 85 % of the energy consumed by the machine goes out the vent.

15 [0003] The stated above inefficiency of conventional drying process is due to the fact that air is a very poor heat conductor. Thus, for example, only very small engines can be air cooled efficiently. On the other hand, some large engines, for example, an automobile engine, or a high power
20 motorcycle engine, use water cooling because water is much better heat conductor than air.

SUMMARY

25 [0004] This Summary is provided to introduce a selection of concepts that are further described below in the Detailed Description. This Summary is not intended to identify key or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[0005] A method for heating an object having a variable weight that includes a medium is provided. The method comprises: (A) placing the object having the variable weight including medium into an enclosure; (B) initiating a heating process by subjecting medium including the object
5 having the variable weight to a variable AC electrical field; and (C) controlling the heating process.

[0006] The object has substantially absorbed medium in a first "cool" state and therefore includes a maximum weight in the first "cool" state due to
10 absorption of medium.

[0007] The object is substantially free from medium in a second "heated" state due to substantial release of medium from the object, wherein the released medium is evaporated during the heating process. The heating
15 process is completed when the object is substantially transitioned into the second "heated" state.

[0008] The method further comprises using an air flow having an ambient temperature inside the enclosure to carry away the evaporated medium
20 from the enclosure.

DESCRIPTION OF THE DRAWINGS

[0009] The accompanying drawings, which are incorporated in and form a part of this specification, illustrate embodiments of the technology and,
25 together with the description, serve to explain the principles below:

[0010] FIG. 1 illustrates a general diagram of a dielectric dryer drum for the purposes of the present technology.

30 [0011] FIG. 2 shows a basic impellor anode RF dryer diagram for the purposes of the present technology.

[0012] FIG. 3 depicts a dielectric heating system block diagram for the purposes of the present technology.

[0013] FIG. 4 illustrates the comparison between the conventional heated air dryer and the proprietary Cool Dry dielectric dryer for the purposes of the present technology.

[0014] FIG. 5 shows a dryer drum and single impellor design example for the purposes of the present technology.

[0015] FIG. 6 depicts RF connections to rotating elements cathode & anode for the purposes of the present technology.

[0016] FIG. 7 illustrates variable anode element coupling for the purposes of the present technology.

[0017] FIG. 8 shows a dielectric load model of the dielectric dryer drum for the purposes of the present technology.

DETAILED DESCRIPTION.

[0018] Reference now is made in detail to the embodiments of the technology, examples of which are illustrated in the accompanying drawings. While the present technology will be described in conjunction with the various embodiments, it will be understood that they are not intended to limit the present technology to these embodiments. On the contrary, the present technology is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the various embodiments as defined by the appended claims.

[0019] Furthermore, in the following detailed description, numerous specific-details are set forth in order to provide a thorough understanding of the presented embodiments. However, it will be obvious to one of ordinary skill in the art that the presented embodiments may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the presented embodiments.

[0020] In an embodiment of the present technology, FIG. 1 illustrates a general diagram 10 of a dielectric dryer drum 12 for the purposes of the present technology. This represents a new way to introduce the RF power into the dryer chamber.

[0021] In an embodiment of the present technology, more specifically, the cylindrical drum 12 having two round cathode plate ends 13 and 15 includes at least three impellers 14 utilized to introduce the RF power (please, see discussion below). An air flow 16 is used to efficiently carry out the evaporated water off the system.

[0022] In an embodiment of the present technology, the volume control block 18 is employed for controlling an air flow rate to facilitate removal of evaporated water from the drum 12.

[0023] In an embodiment of the present technology, an air path is controlled by selecting an element design (from the group consisting of: an intake air duct design (not shown), an air chamber design (not shown), and a drum impellor design (see discussion below). The element design is configured to facilitate removal of evaporated water from the drum 12.

[0024] Essentially this new way to introduce the RF into the chamber allows us to maintain the size and volume of the chamber constant, without moving parts inside. Also, the tuning out of the reactive component of the load could be accomplished by turning on or off, all or
5 some of the impellor vanes inside the drum.

[0025] In an embodiment of the present technology, referring still to FIG. 1 the impellors 14 of the dielectric dryer drum 12 now have a double function: to scramble the clothes for better exposure to the air that removes
10 the moisture, and also to provide the RF anode connection.

[0026] In an embodiment of the present technology, more specifically, the impellors 14 of the dryer drum 12 are now used as anodes for connection to the load with variable materials (including fabrics), weight and
15 moisture.

[0027] In an embodiment of the present technology, the load effective shape and volume is varied by the drum rotation speed & direction, drum shape and impellor design to optimize energy transfer from the RF power
20 source to the load over the drying cycle.

[0028] For example, semispherical protrusions (not shown) could be engineered on the end plates to help put tumbling clothes into a more optimum dynamic shape for RF coupling.
25

[0029] In an embodiment of the present technology, FIG. 2 shows a basic impellor anode RF dryer diagram 20 for the purposes of the present technology.

[0030] In an embodiment of the present technology, the drum material 24 is selected from the group consisting of: a conductor; a metal; an insulator; a dielectric insulator; a ceramic insulator; a plastic insulator; a wooden insulator; and a mixture of at least two drum materials.

5 [0031] In an embodiment of the present technology, an object inside the rotating drum 24 is selected from the group consisting of: a cloth substance; a food substance; a wood substance; a plastic substance; and a chemical substance.

10 [0032] In an embodiment of the present technology, we will focus on the object 22 comprising a moist load of clothing.

[0033] In an embodiment of the present technology, all drum surfaces are grounded 26.

15

[0034] In an embodiment of the present technology, each drum impellor is driven with RF energy as a "hot anode" (28, 30), with ground return being the entire drum surface 32. Each impellor is shaped and placed into the drum in a manner to maximize RF coupling to the tumbling, or stationary, load while minimizing non load coupled "parasitic" capacitance.

20

[0035] In an embodiment of the present technology, each anode element (28, 30) is separated from the conductive drum surface 32 by an insulating material 36.

25

[0036] In an embodiment of the present technology, the insulating material 36 is selected from the group consisting of: glass; plastic; and ceramic.

[0037] In an embodiment of the present technology, referring still to FIG. 2, the conductive cathode area 32 of the rotating drum 24 is connected to the, ground return path 26 of the RF power source by a connection selected from a from the group consisting of: a rotating capacitive connection; and
5 a non rotating capacitive connection.

[0038] In an embodiment of the present technology, referring still to FIG. 2, we will focus our discussion on the rotating RF cathode drum RF connection 34.

10 [0039] In an embodiment of the present technology, referring still to FIG. 2, at least one anode element (28, 30) is connected to the RF power source 46 by a connector comprising the rotating RF anode plate connector 38.

15 [0040] In an embodiment of the present technology, the rotating RF anode plate connector 38 is connected to RF Power source 46 by using a variable tuning inductor 42.

20 [0041] In an embodiment of the present technology, the variable tuning inductor 42 is used to achieve the RF tuning for optimum power transfer from the DC Supply voltage 48.

[0042] In an embodiment of the present technology, the drum is rotated with varying rotation speed to optimize RF coupling.

25 [0043] In an embodiment of the present technology, the direction of rotation of said drum is varied to optimize RF coupling by preventing bunching of the drying load.

[0044] In an embodiment of the present technology, the variable tuning inductor 42 adjusts its value to tune out the $(-jX)$ from the load RF impedance 40, thus yielding a pure resistive load, R at the feed point 52.

5 [0045] In an embodiment of the present technology, FIG. 3 depicts a dielectric heating system bloc diagram 60 comprising a DC power supply 72, a real time configurable RF waveform power source 70, a system controller & signal processor 66, a serial port 68, a block 64 of RF & physical sensors; and a dryer drum 62.

10

[0046] In an embodiment of the present technology, the heating process is controlled by selecting parameters of the real time configurable RF waveform power source 70 from the group consisting of: an applied RF voltage magnitude and envelope wave shape; an applied RF current
15 magnitude and envelope wave shape; phase of RF voltage vs. current; voltage standing wave ratio (VSWR); and RF frequency.

[0047] In an embodiment of the present technology, the block 64 of RF & physical sensors are configured to measure the load RF impedance in order
20 to measure the size and water content of the load, to measure the load temperature, and to measure parameters of the air flow.

[0048] In an embodiment of the present technology, the system controller & signal processor 66 is configured to control parameters of the real time
25 configurable RF waveform power source 70 by using the real time data provided by the block 64 of RF & physical sensors.

[0049] FIG. 4 illustrates the comparison diagram 100 between the conventional heated air dryer 101 and the proprietary Cool Dry dielectric dryer 103 for the purposes of the present technology.

30

[0050] In the conventional heated air dryer, the 4kW applied power 108 causes heating of the hot air 104 up to 300°F 110 due to evaporation of air heated water 106. Such hot temperature adversely affects the properties of the drying fabric.

5

[0051] On the other hand, in the proprietary Cool Dry dielectric dryer 103 the 4kW applied RF power 112 causes evaporation of air heated water 114 but does not cause heating of the ambient air 118 that has temperature only up to 90°F (room temperature). Such ambient temperature does not adversely affect the properties of the drying fabric.

10

[0052] FIG. 5 shows a dryer drum and single impellor design example 140 for the purposes of the present technology. There are tumbling load air gaps between the tumbling loads 150 and 148 and the anode plate 162 depending on the tumbling load shape 158 and the anode shape 162 and placement 160.

15

[0053] In an embodiment of the present technology, the anode plate shape 162 is optimized for best load RF coupling vs. lower parasitic capacitance to ground.

20

[0054] In an embodiment of the present technology, the anode plate shape 162 is optimized to accommodate for different kind of fabrics and different kind of load.

25

[0055] In an embodiment of the present technology, the anode plate placement 160 is also optimized so that the parameter G 154 (net average spacing to a tumbling load) and the parameter H 156 (parasitic capacitive coupon from the anode plate to the drum cathode ground) are optimized together for best load coupling vs. lower parasitic capacitance to ground.

30

[0056] In an embodiment of the present technology, the rotating RF anode plate connector 38 (of FIG. 3) is selected from the group consisting of: a brush-contact commutator; and a capacitive coupling.

5 [0057] In an embodiment of the present technology, the rotating RF anode plate connector 38 (of FIG. 3) comprises a capacitive coupling selected from the group consisting of: a parallel plate; and at least one concentric cylinder.

10 [0058] More specifically, FIG. 6 depicts diagram 200 of RF connections to rotating elements cathode & anode for the purposes of the present technology.

[0059] In an embodiment of the present technology, the anode plate is
15 connected to the RF source by using a fixed contact brush (204 of FIG. 6).

[0060] In an embodiment of the present technology, the anode plate is connected to the RF source by using a rotating brush commutator (202 of FIG. 6).

20 [0061] In an embodiment of the present technology, the anode plate is connected to the RF source by using a capacitive disc coupler (208 of FIG. 6).

25 [0062] In an embodiment of the present technology, the anode plate is connected to the RF source by using at least one capacitive cylinder disc coupler (210 of FIG. 6).

[0063] FIG. 7 is a diagram 220 that illustrates variable anode element
30 coupling for the purposes of the present technology.

[0064] In an embodiment of the present technology, the conductive area of the fixed anode plate 222 is shown in a rear view.

5 [0065] In an embodiment of the present technology, the fixed anode plate 228 and rotating plate 226 are shown in, a side view 224.

[0066] In an embodiment of the present technology, the conductive capacitor plates 232, 234, and 236 are perpendicular (shown by legend 242) connected to the anode element 240.

10

[0067] FIG. 8 shows the dielectric load model 260 of the dielectric dryer drum for the purposes of the present technology.

[0068] The drum has a fundamental capacitance, 262 based on its physical dimensions and air dielectric permittivity 264. The water in the load has an RF resistance 266 related to the amount of water contained. The materials in the load add an additional capacitance 268 to the model, based on their dielectric constant > 1 . Thus, the load impedance 270 is:

15

20
$$Z = R + jX$$
 (Eq. 1)

[0069] The load impedance Z is dependent on: load size, water content; fabric types, and physical shape and volume.

25 [0070] The basic principle is dynamically maximized RF coupling to the load resistance (water). The design optimizes the water resistance while minimizing parasitic capacitance 268.

[0071] In an embodiment of the present technology, the capacitive element of the load 268 could be minimized or perhaps totally eliminated by driving a different number of impellers with the RF source during the drying cycle. with mechanically staggered coupling capacitors.

5

[0072] In an embodiment of the present technology, as was disclosed above, FIG. 2 illustrates an example of the design optimization by the spacing of the impeller anode above the drum ground to minimize capacitance consistent with optimum load coupling.

10

[0073] In an embodiment of the present technology, the RF impedance of the load can be used to measure water content in real-time.

[0074] In an embodiment of the present technology, the method for heating an object having a variable weight that includes a medium comprises the step of placing the object having the variable weight including the medium into an enclosure; wherein the object substantially has absorbed the medium in a first "cool" state; and wherein the object includes a maximum weight in the first "cool" state due to absorption of the medium.

20

[0075] In an embodiment of the present technology, the method for heating an object having a variable weight that includes a medium further comprises the step of initiating a heating process by subjecting the medium including the object to a variable AC electrical field; wherein the object is substantially free from the medium in a second "heated" state due to substantial release of the medium from the object; and wherein the released medium is evaporated during the heating process.

30

[0076] In an embodiment of the present technology, the method for heating an object having a variable weight that includes a medium further comprises the step of controlling the heating process, wherein the heating process is completed when the object is substantially transitioned into the second "heated" state.

[0077] In an embodiment of the present technology, the method for heating an object having a variable weight that includes a medium further comprises the step of using an air flow having an ambient temperature inside the enclosure to carry away the evaporated medium from the enclosure.

[0078] In an embodiment of the present technology, wherein the enclosure comprises a dryer drum 24 version of the enclosure having at least one anode element impellor 28 (30) of variable shape, and at least one cathode area 32, and wherein the object comprises a load of clothing 22, and wherein the medium comprises water, as shown in FIG. 2, the method for heating the load of clothing 22 further comprises the step of optimally configuring the shape of at least one anode (impeller) to accommodate for different kind of fabrics and different kind of load.

[0079] In an embodiment of the present technology, wherein the enclosure comprises a dryer drum 24 version of the enclosure having at least one anode element impellor 28 (30) of variable shape, and at least one cathode area 32, and wherein the object comprises a load of clothing 22, and wherein the medium comprises water, as shown in FIG. 2, the method for heating the load of clothing 22 further comprises the step of pre-heating air inside the dryer drum 24 to facilitate water evaporation from the drum.

[0080] In an embodiment of the present technology, wherein the enclosure comprises a dryer drum 24 version of the enclosure having at least one anode element impellor 28 (30) of variable shape, and at least one cathode area 32, and wherein the object comprises a load of clothing 22, and
5 wherein the medium comprises water, as shown in FIG. 2, the method for heating the load of clothing 22 further comprises the step of controlling an air flow rate by volume control block (18 of FIG. 1) to facilitate removal of evaporated water from the drum enclosure.

10 [0081] In an embodiment of the present technology, wherein the enclosure comprises a dryer drum 24 version of the enclosure having at least one anode element impellor 28 (30) of variable shape, and at least one cathode area 32, and wherein the object comprises a load of clothing 22, and
15 wherein the medium comprises water, as shown in FIG. 2, the method for heating the load of clothing 22 further comprises the step of controlling an air flow path by an element design selected from the group consisting of : an intake air duct design (not shown); a chamber design (not shown); and a drum impellor design (162 of FIG. 5). The element design is configured to facilitate removal of evaporated water from the drum enclosure.

20 [0082] The above discussion has set forth the operation of various exemplary systems and devices, as well as various embodiments pertaining to exemplary methods of operating such systems and devices. In various embodiments, one or more steps of a method of implementation are carried
25 out by a processor under the control of computer-readable and computer-executable instructions. Thus, in some embodiments, these methods are implemented via a computer.

[0083] In an embodiment, the computer-readable and computer-executable
30 instructions may reside on computer useable/readable media.

[0084] Therefore, one or more operations of various embodiments may be controlled or implemented using computer-executable instructions, such as program modules, being executed by a computer. Generally, program modules include routines, programs, objects, components, data structures, etc., that perform particular tasks or implement particular abstract data types. In addition, the present technology may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote computer-storage media including memory-storage devices.

[0085] Although specific steps of exemplary methods of implementation are disclosed herein, these steps are examples of steps that may be performed in accordance with various exemplary embodiments. That is, embodiments disclosed herein are well suited to performing various other steps or variations of the steps recited. Moreover, the steps disclosed herein may be performed in an order different than presented, and not all of the steps are necessarily performed in a particular embodiment.

[0086] Although various electronic and software based systems are discussed herein, these systems are merely examples of environments that might be utilized, and are not intended to suggest any limitation as to the scope of use or functionality of the present technology. Neither should such systems be interpreted as having any dependency or relation to any one or combination of components or functions illustrated in the disclosed examples.

[0087] Although the subject matter has been described in a language specific to structural features and/or methodological acts, the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as exemplary forms of implementing the claims.

Claims

1. A method for heating an object having a variable weight that includes a medium; said method comprising:

5 (A) placing said object having said variable weight including said medium into an enclosure; wherein said object substantially has absorbed said medium in a first “cool” state; and wherein said object includes a maximum weight in said first “cool” state due to absorption of said medium;

(B) initiating a heating process by subjecting said medium including
10 said object having said variable weight to a variable AC electrical field; wherein said object is substantially free from said medium in a second “heated” state due to substantial release of said medium from said object; and wherein said released medium is evaporated during said heating process;
and

15 (C) controlling said heating process, wherein said heating process is completed when said object is substantially transitioned into said second “heated” state.

2. The method of claim 1 further comprising:

20 (D) using an air flow having an ambient temperature inside said enclosure to carry away said evaporated medium from said enclosure.

3. The method of claim 1, wherein said step (A) further comprises:

(A1) selecting said medium from the group consisting of: water; a
25 liquid having a dielectric permittivity above a first predetermined threshold; and a liquid having a dissipation factor above a second predetermined threshold.

4. The method of claim 1, wherein said step (A) further comprises:

(A2) selecting said object from the group consisting of:

a cloth substance; a food substance; a wood substance; a plastic substance;
5 and a chemical substance.

5. The method of claim 1, wherein said step (A) further comprises:

(A3) selecting an enclosure having at least one anode element.

10 6. The method of claim 1, wherein said step (A) further comprises:

(A4) selecting an enclosure from the group consisting of:

a cylindrical cathode drum having at least one impellor; and a cylindrical
drum having at least one impellor and having at least one cathode end plate.

15 7. The method of claim 1, wherein said step (A) further comprises:

(A5) selecting an enclosure material from the group consisting of:

a conductor; a metal; an insulator; a dielectric insulator; a ceramic insulator;
a plastic insulator; a wooden insulator; and a mixture of at least two drum
materials.

20

8. The method of claim 1, wherein said step (B) further comprises:

(B1) applying RF energy to at least one said anode element within

said enclosure.

25

9. The method of claim 1, wherein said step (B) further comprises:

(B2) applying RF energy to at least one said impellor configured to function as an anode element inside a drum enclosure; and wherein at least part of said conductive drum surface is configured to function as a cathode ground return; and wherein at least one said anode element is separated from said conductive drum surface by an insulating material.

10. The method of claim 1, wherein said step (B) further comprises:

(B3) shaping at least one surface area of a drum shaped enclosure to maximize RF coupling to the load.

11. The method of claim 1, wherein said step (B) further comprises:

(B4) making at least one protrusion on at least one end plate of a drum enclosure to optimize RF coupling; said at least one protrusion is selected from the group consisting of: a concave protrusion; and a convex protrusion.

12. The method of claim 1, wherein said step (B) further comprises:

(B5) rotating said drum with varying rotation speed to optimize RF coupling.

13. The method of claim 1, wherein said step (B) further comprises:

(B6) selecting parameters of said variable AC electrical field from the group consisting of: an applied RF voltage magnitude and envelope wave shape; an applied RF current magnitude and envelope wave shape; phase of RF voltage vs. current; voltage standing wave ratio (VSWR); and RF frequency.

14. The method of claim 1, wherein step (B) further comprises:

(B7) selecting a connection from a conductive cathode area of said moving enclosure to a ground return path of said RF power source from the group consisting of: a rotating capacitive connection; and a non rotating capacitive connection.

15. The method of claim 1, wherein said step (B) further comprises:

(B8) selecting a connection from at least one said anode element to an RF power source from the group consisting of: a brush-contact commutator; and a capacitive coupling.

16. The method of claim 1, wherein said step (B) further comprises:

(B9) selecting said capacitive coupling from the group consisting of: a parallel plate; and at least one concentric cylinder.

17. The method of claim 1, wherein said step (C) further comprises:

(C1) substantially continuously measuring impedance of said medium including said object having said variable weight during said heating process.

18. The method of claim 17, wherein said step (C1) further comprises:

(C1, 1) using correlation between said continuously measured value of impedance of said medium and a moisture content of said object to determine said moisture content of said object.

19. The method of claim 1, wherein said step (C) further comprises:

(C2) measuring a set of parameters of said medium including said object having said variable weight during said heating process; said set of parameters selected from the group consisting of: an impedance at least at
5 one RF frequency; temperature variations of said object within said enclosure; moisture variations of said object within said enclosure; and weight variations of said object

20. The method of claim 2, wherein said enclosure comprises a dryer
10 drum version of the enclosure having at least one anode element impellor of variable shape, and at least one cathode area, and wherein said object comprises a load of clothing; and wherein said medium comprises water; and wherein said step (D) further comprises:

(D1) inserting pre-heated air inside said dryer drum to facilitate water
15 evaporation from said enclosure.

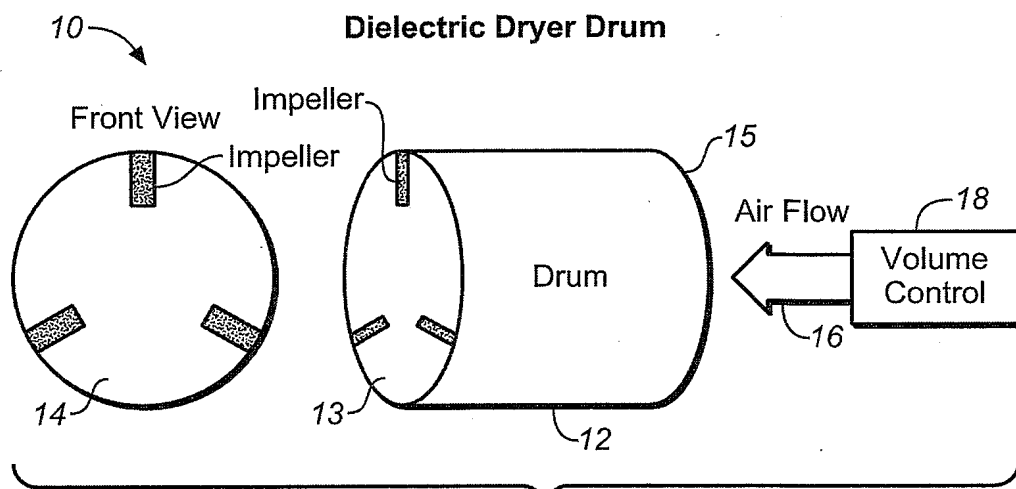
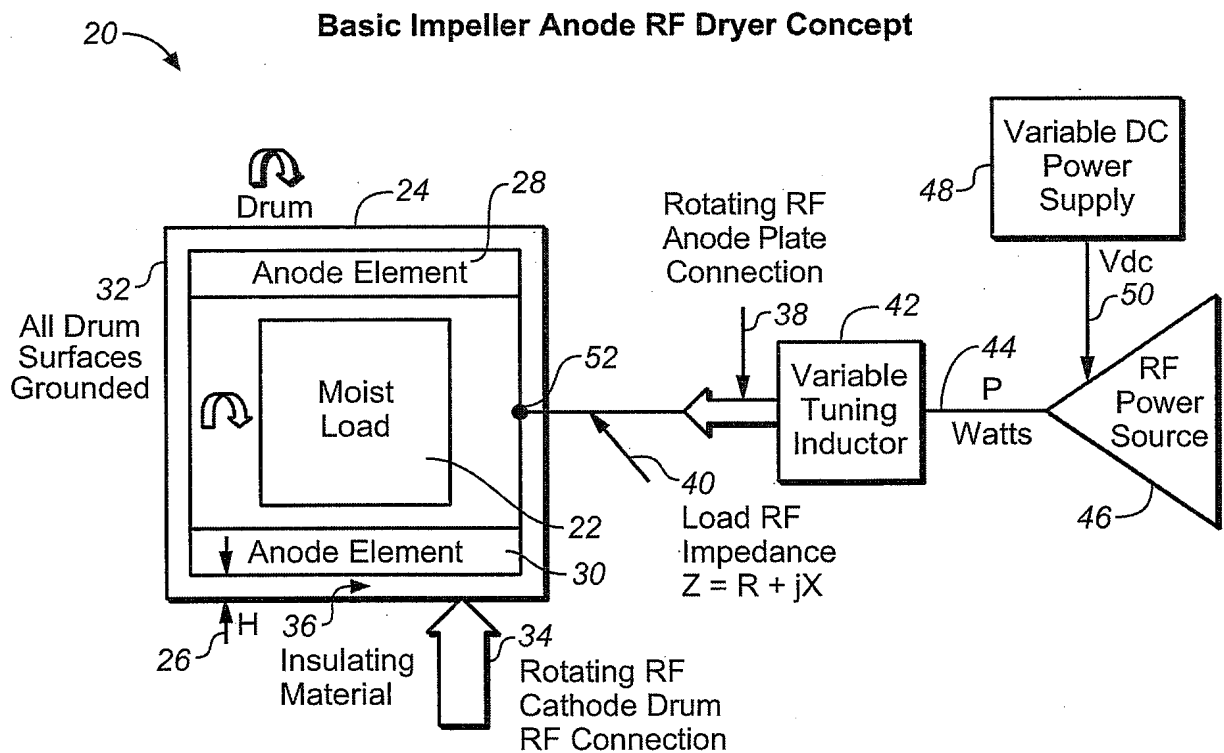
21. The method of claim 2, wherein said enclosure comprises a dryer
drum version of the enclosure having at least one anode element impellor of variable shape, and at least one cathode area, and wherein said object
20 comprises a load of clothing; and wherein said medium comprises water; and wherein said step (D) further comprises:

(D2) controlling an air flow rate by volume control to facilitate removal of evaporated water from said enclosure.

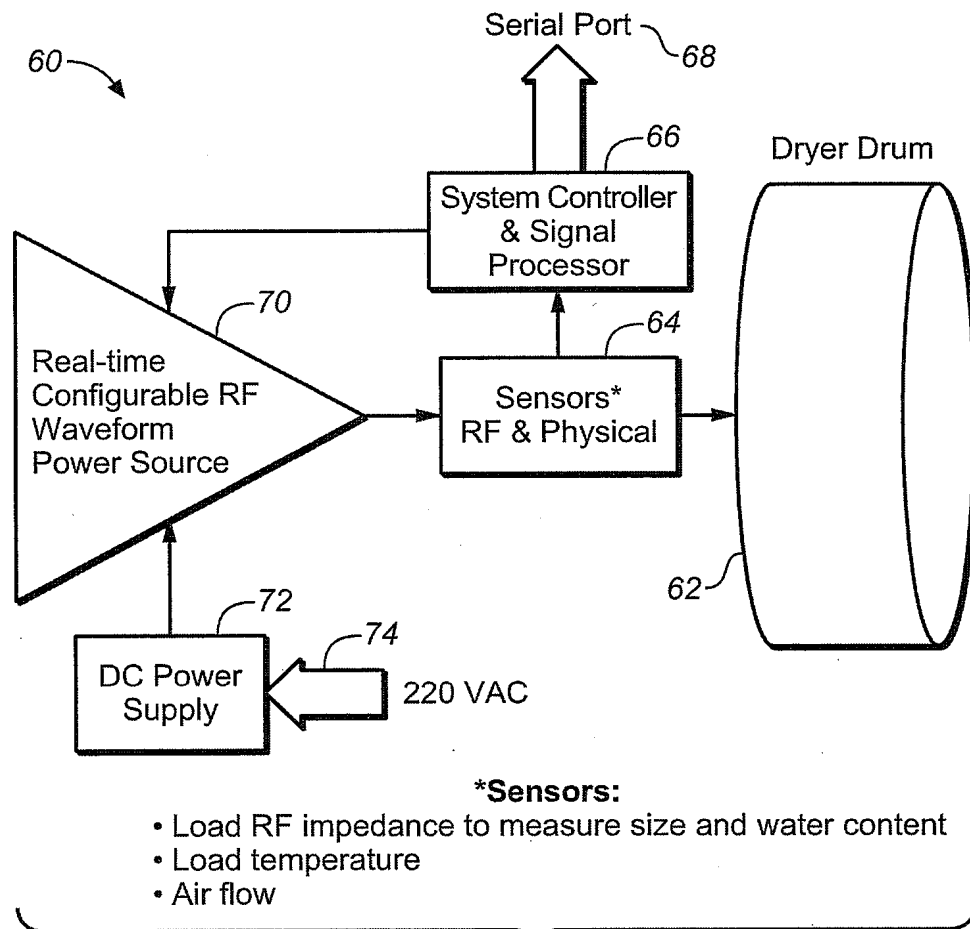
22. The method of claim 2, wherein said enclosure comprises a dryer drum version of the enclosure having at least one anode plate impellor of variable shape, and at least one cathode area, and wherein said object comprises a load of clothing; and wherein said medium comprises water; and wherein said step (D) further comprises:

(D3) controlling an air flow path by an element design selected from the group consisting of : an intake air duct design; a chamber design; and a drum impellor design; wherein said element design is configured to facilitate removal of evaporated water from said enclosure.

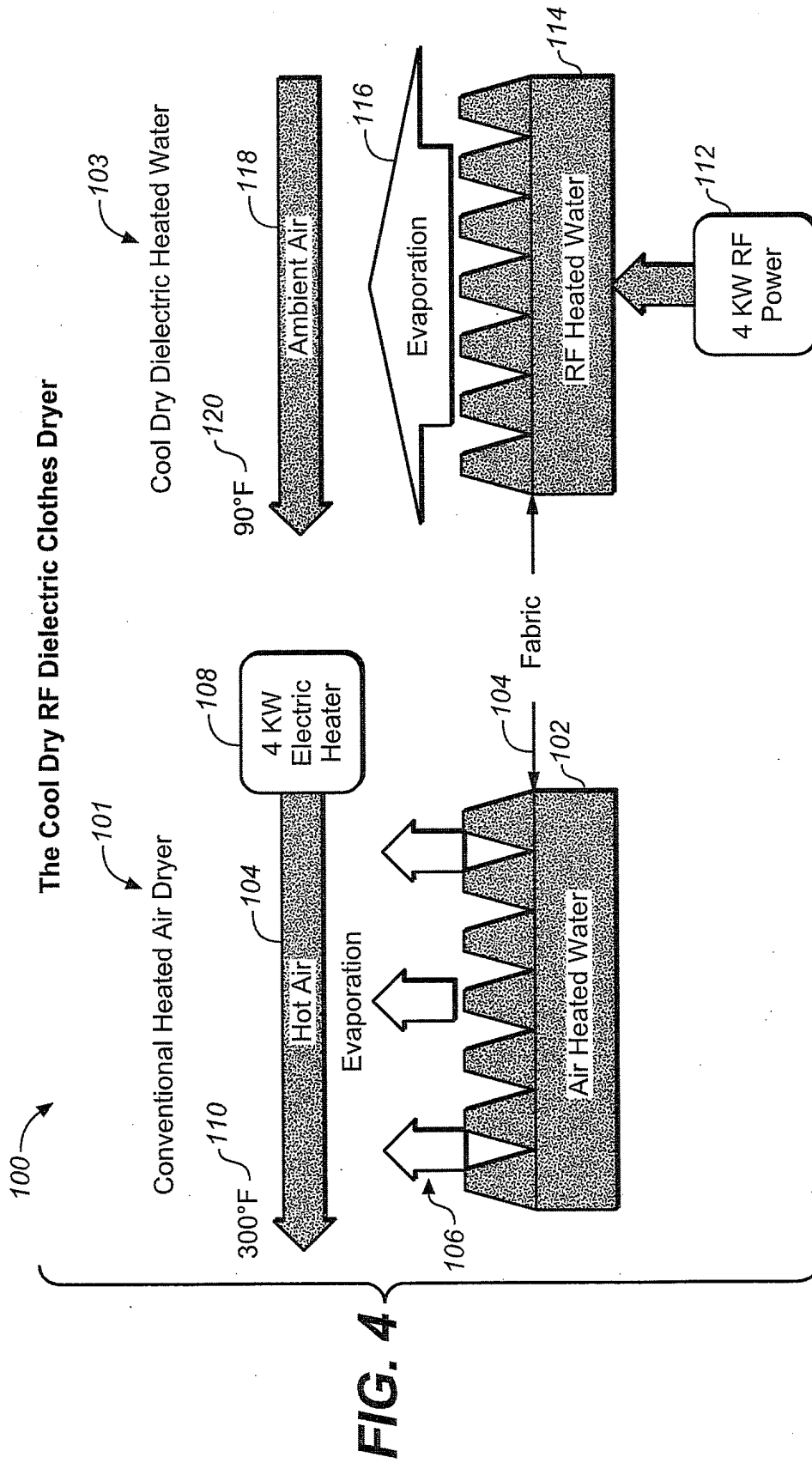
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**FIG. 1****FIG. 2**

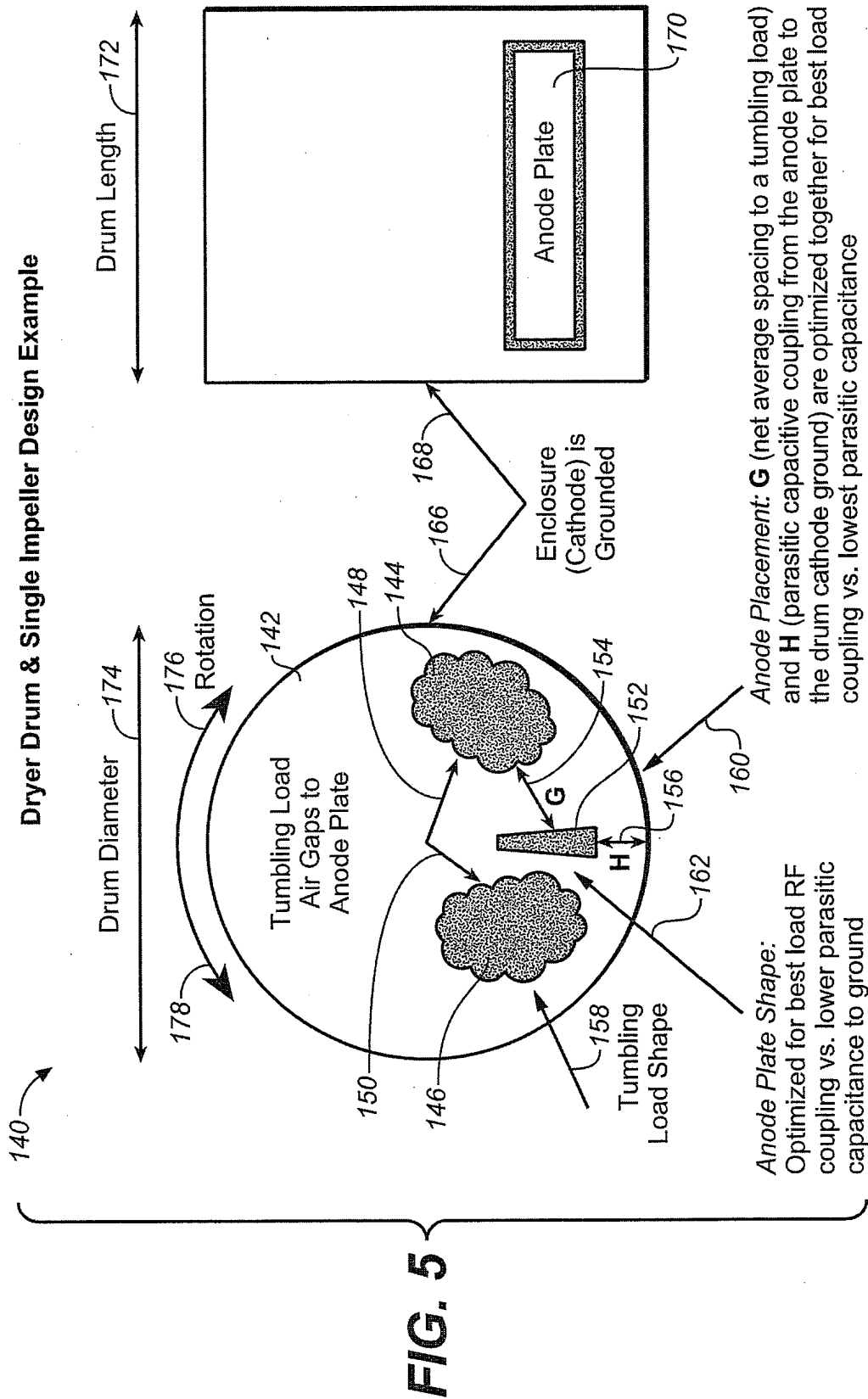
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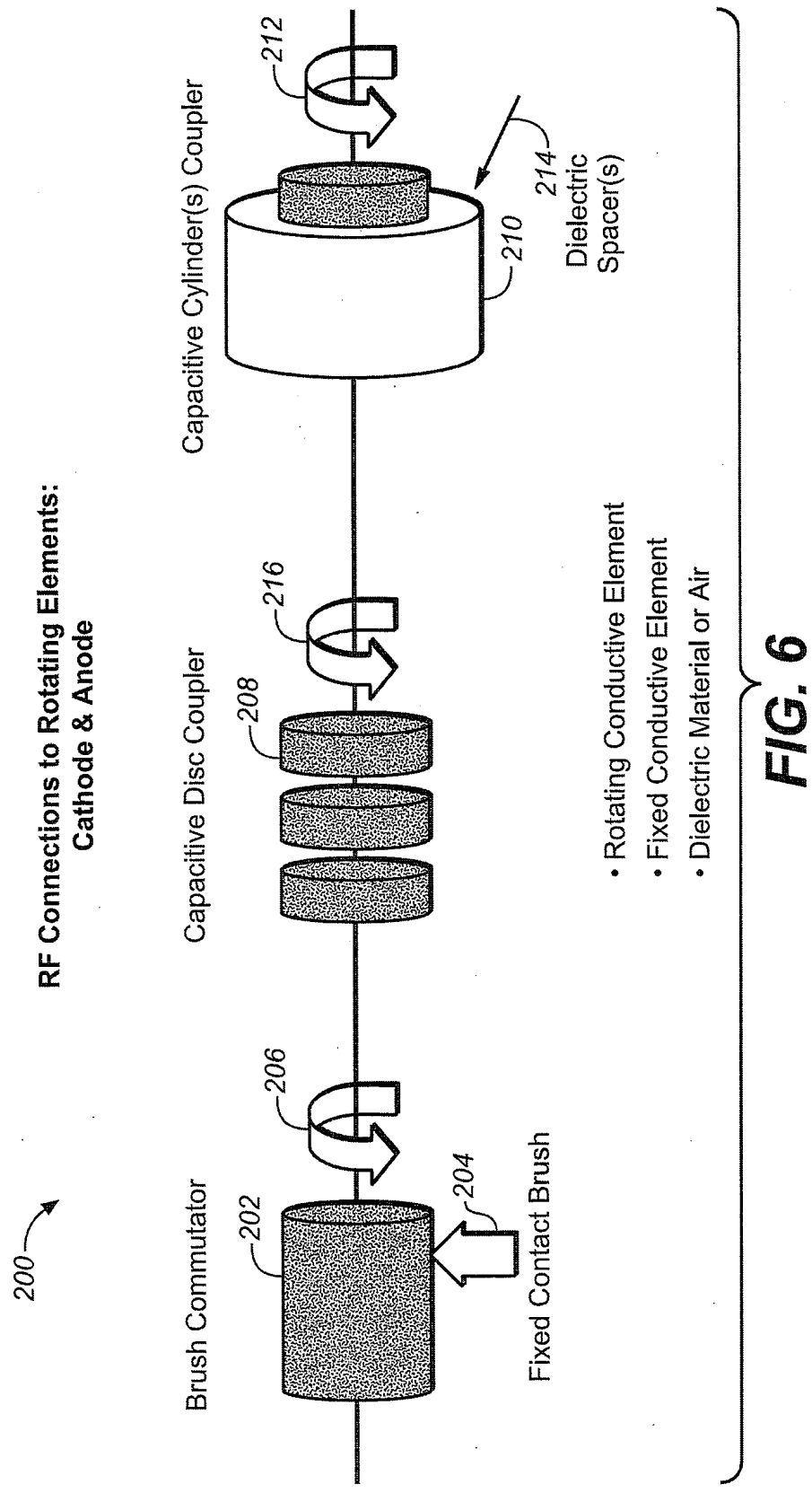
Dielectric Heating System Block Diagram**FIG. 3**

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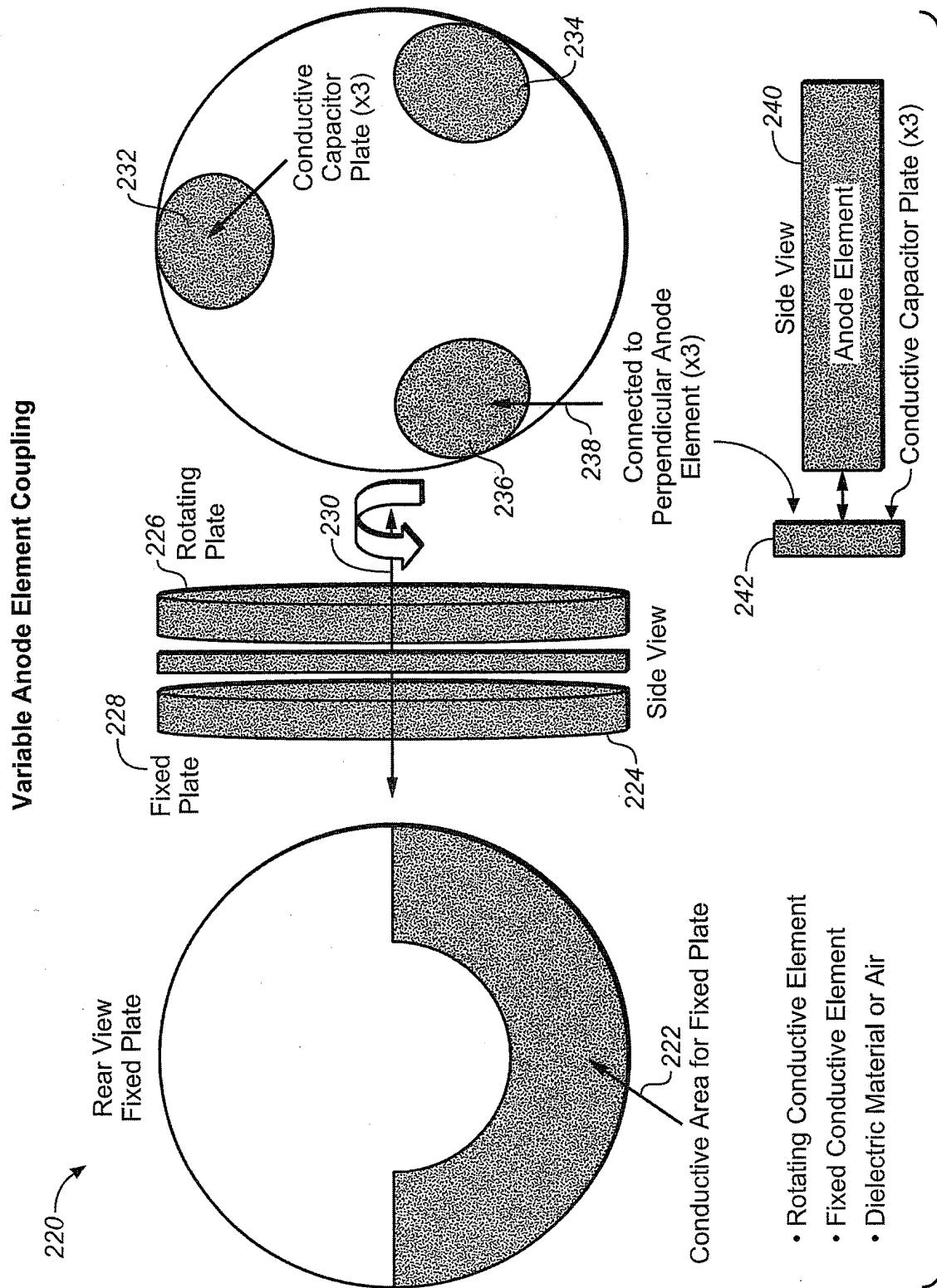
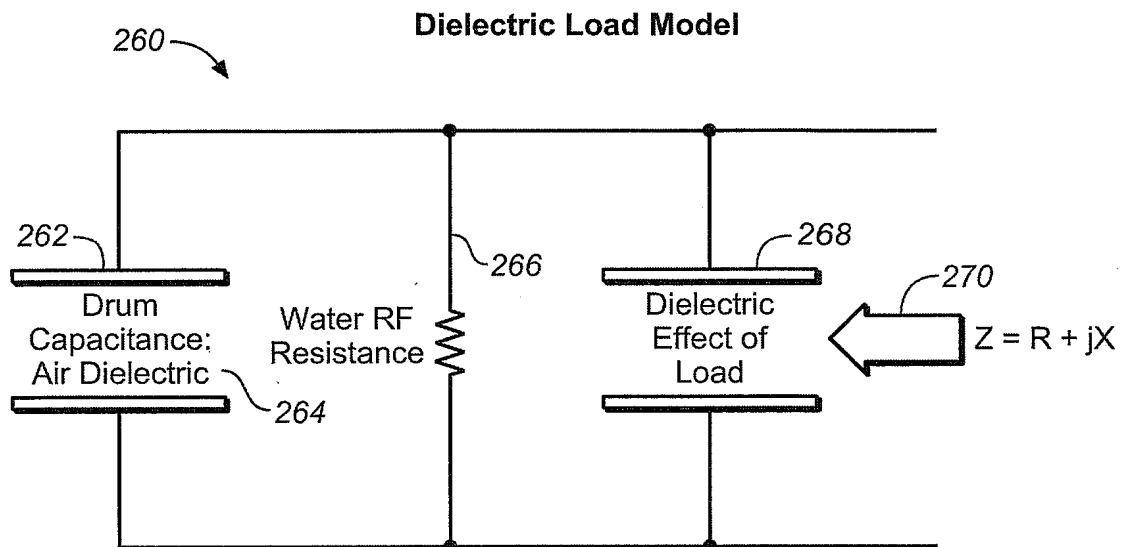


FIG. 7

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- The water resistance rises as the load dries
- The load impedance (Z) is dependent on:
 - Load size
 - Water content
 - Fabric types
 - Physical shape and volume

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 12/33900

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F26B 3/347 (2012.01)

USPC - 34/255; 34/260

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)

IPC(8): F26B 3/347 (2012.01)

USPC: 34/255; 34/260

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

IPC(8): F26B 3/347 (2012.01)

USPC: 34/255; 34/260 (keyword delimited)

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

PubWEST; PGPB, USPT, EPAB, JPAB; Google Scholar; Google Patent

Search Terms Used: RF radio frequency heat dryer microwave agitator impeller drum tumble water moisture antenna clothes fabric cloth detector sensor rotate axis bearing cavity housing fan blower impedance capacitive

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/0115785 A1 (Ben-Shmuel et al.) 13 May 2010 (13.05.2010), para. [0025] through [0976], Fig. 1-34	1-22
A	US 2009/0236334 A1 (Ben-Shmuel et al.) 24 September 2009 (24.09.2009), entire document	1-22
A	US 2007/0271814 A1 (Bae et al.) 29 November 2007 (29.11.2007), entire document	1-22
A	US 7,380,423 B1 (Musone) 03 June 2008 (03.06.2008), entire document	1-22
A	US 5,983,520 A (Kim et al.) 16 November 1999 (16.11.1999), entire document	1-22

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

"T" 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

18 July 2012 (18.07.2012)

Date of mailing of the international search report

03 AUG 2012

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PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 12/33900

Box No. IV **Text of the abstract (Continuation of item 5 of the first sheet)**

Heating an object, (food, wet clothing) having a variable weight that includes a medium (water) comprising: placing the object having the variable weight including medium into an enclosure; initiating a heating process by subjecting object with medium to a variable AC electrical field; and controlling the heating process. The object/clothing having a first "cool" state and therefore includes a maximum weight in the first "cool" state due to absorption of medium. The object is substantially free from the medium/water in a second "heated" state due to substantial evaporation of the medium from the object. Heating process is completed when the object is substantially transitioned into the second "heated" state. The method further comprises using an air flow having an ambient temperature inside the enclosure to carry away the evaporated medium from the enclosure.

(12) 特許協力条約に基づいて公開された国際出願

(19) 世界知的所有権機関
国際事務局

(43) 国際公開日
2022年11月3日(03.11.2022)



(10) 国際公開番号

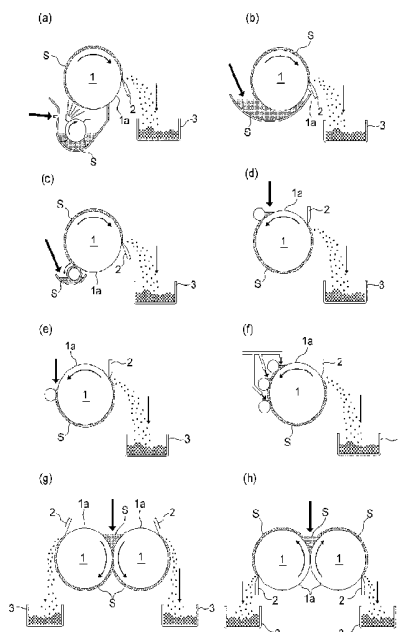
WO 2022/230838 A1

- (51) 国際特許分類:
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A21D 2/18 (2006.01) A23L 7/109 (2016.01)
A21D 13/00 (2017.01)
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- (30) 優先権データ:
特願 2021-076694 2021年4月28日(28.04.2021) JP
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(54) Title: METHOD FOR PRODUCING PREGELATINIZED GRAIN FLOUR

(54) 発明の名称: α 化穀粉の製造方法

[図1]



(57) Abstract: The method for producing a pregelatinized grain flour according to the present invention includes a step for thermally drying a slurry, which contains 100 parts by mass of grain flour and 500-1500 parts by mass of water, using a drum dryer. Preferably, the grain flour contains wheat flour. Preferably, the grain flour contains one or more selected from low-amylose wheat flour and a glutinous grain flour. Preferably, the temperature of the heating section of the drum dryer is 100-150 °C. A method for producing a processed food according to the present invention is characterized in that a pregelatinized grain flour produced by the aforesaid production method is used as a starting material.

(57) 要約: 本発明の α 化穀粉の製造方法は、穀粉100質量部及び水500～1500質量部を含むスラリーをドラムドライヤーで加熱乾燥する工程を含む。前記穀粉は小麦粉を含むことが好ましい。前記穀粉は、低アミロース小麦粉及び糯種穀粉から選択される1種以上を含むことが好ましい。前記ドラムドライヤーの加熱部の温度は好ましくは100～150℃である。本発明の加工食品の製造方法は、前記の製造方法で製造された α 化穀粉を原料として用いることを特徴とする。

[続葉有]



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(81) 指定国(表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) 指定国(表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY, KG, KZ, RU, TJ, TM), ヨーロッパ (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

規則4.17に規定する申立て:

- 出願し及び特許を与えられる出願人の資格に関する申立て (規則4.17(ii))

添付公開書類:

- 国際調査報告 (条約第21条(3))

明 細 書

発明の名称： α 化穀粉の製造方法

技術分野

[0001] 本発明は、食品の原料として使用可能な α 化穀粉に関する。

背景技術

[0002] α 化穀粉は、小麦粉等の穀粉を水分存在下で加熱して、該穀粉に含まれる澱粉を α 化（糊化）させたものであり、食品用途や工業用途などに幅広く用いられている。 α 化穀粉の製造方法としては従来、穀粉を含むスラリーをスプレードライヤー、ドラムドライヤーなどを用いて乾燥する方法、穀粉に加水してエクストルーダーで混練しつつ加熱する方法、穀粉が収容された容器内に過熱蒸気を通して加熱・加湿する方法などが知られている。

[0003] 特許文献1には、ドラムドライヤー乾燥適性及び水分散性に優れるコーンパウダーの製造方法として、 α -アミラーゼ処理されたコーンペーストにハイアミロース澱粉を配合したものをドラムドライヤーで乾燥する工程を含むものが記載され、また、斯かるドラムドライヤーによる乾燥処理に関して、ドライヤーの表面温度を100～180℃、乾燥時間を2～240秒にすることが記載されているが、被乾燥物（コーンペーストとハイアミロース澱粉との混合物）に対する加水量は具体的に記載されていない。特許文献2には、小麦粉を含有する食品において良好な食感を付与し得る食品用 α 化変性澱粉として、澱粉に小麦粉を配合した澱粉小麦粉配合物をドラムドライヤーで α 化処理して得られるものが記載され、また、斯かるドラムドライヤーによる α 化処理に関して、ドラムドライヤーの加熱部に滴下する水懸濁液における澱粉小麦粉配合物の濃度を30～50質量%とすることが記載されている。特許文献3には、食感及び風味が良好で老化が遅いパンを製造し得るパン用小麦粉が記載され、また、該パン用小麦粉に用いる α 化小麦粉として、原料小麦粉を1～3倍の水と混合したものをドラムドライヤーで乾燥して得られるものをを用いることが記載されている。

先行技術文献

特許文献

[0004] 特許文献1：特開2019-198243号公報

特許文献2：特開2007-169442号公報

特許文献3：特開2004-129607号公報

発明の概要

[0005] 澱粉を比較的多く含む食品においては、澱粉の老化が問題となる。例えば、小麦粉を主体とするベーカリー食品においては、その保存中に小麦粉中の澱粉の老化が進行する結果、製造直後はしっとりとして柔らかく良好な食味食感であったものが、一定時間の保存後はパサついていて硬い食感となるなど、食味食感が経時的に劣化する問題がある。澱粉の老化耐性に優れ、製造直後のみならず、製造後に保存した場合でも食味食感に優れる二次加工品を製造し得る α 化穀粉は未だ提供されていない。

[0006] 本発明の課題は、食味食感が良好で、経時劣化耐性に優れる二次加工品を製造可能な α 化穀粉を提供することである。

[0007] 本発明者は、澱粉の老化耐性を向上させ得る技術について種々検討した結果、穀粉100質量部に対して500質量部以上の比較的多量の水を加えたスラリーを調製し、該スラリーをドラムドライヤーで加熱乾燥することによって得られた α 化穀粉は、澱粉の老化耐性に優れ、前記課題を解決し得るものであることを知見した。ドラムドライヤーを用いた α 化穀粉の製造方法は、特許文献1～3にも記載されており従来公知であるが、その場合の原料穀粉に対する加水量は通常、穀粉100質量部に対して多くても300質量部程度であり、これを500質量部以上とすることで澱粉の老化耐性が向上し得ることは知られていない。

[0008] 本発明は、前記知見に基づきなされたもので、穀粉100質量部及び水500～1500質量部を含むスラリーをドラムドライヤーで加熱乾燥する工程を含む、 α 化穀粉の製造方法である。

また本発明は、前記の本発明の製造方法で製造された α 化穀粉を原料とし

て用いる、加工食品の製造方法である。

図面の簡単な説明

[0009] [図1]図1 (a)～図1 (h) は、それぞれ、本発明の α 化穀粉の製造方法に使用可能なドラムドライヤーの一例の模式図である。

発明を実施するための形態

[0010] 本発明の α 化穀粉の製造方法は、穀粉及び水を含むスラリーを調製する工程（スラリー調製工程）と、該スラリーを加熱乾燥する工程（スラリー乾燥工程）とを有する。前記スラリー乾燥工程により、スラリー中の穀粉に含まれる澱粉が α 化され、目的の α 化穀粉が得られる。

[0011] 前記スラリー調製工程で用いる穀粉は、澱粉を含む穀粉であればよく、アミロース含量の多少は問わず、粳種でも糯種でもよい。ここで言う「穀粉」には、穀物穎果を構成する主要3成分（胚乳部、外皮部、胚部）のうち、胚乳部を主体とするもの（例えば小麦粉）のみならず、外皮部及び／又は胚部を含むもの、例えば全粒粉（小麦であれば小麦全粒粉）のような態様も包含される。穀粉の具体例として、小麦粉、米粉、そば粉、ライ麦粉、大豆粉が挙げられる。小麦粉としては、強力粉、中力粉、薄力粉、デュラム小麦粉、デュラムセモリナが挙げられる。本発明では α 化穀粉の原料として、1種類の穀粉を用いてもよく、2種類以上の穀粉を併用してもよい。

[0012] 前記スラリー調製工程で用いる穀粉は、小麦粉を含むことが好ましい。 α 化穀粉の原料として小麦粉を用いることで、特に澱粉を使用した場合と比較して、ベーカリー食品、麺類等の二次加工品に小麦らしい風味をより確実に付与し得る。

[0013] 前記スラリー調製工程で用いる穀粉は、低アミロース小麦粉及び糯種穀粉から選択される1種以上を含むことが好ましい。 α 化穀粉の原料として低アミロース小麦粉又は糯種穀粉を用いることで、本発明の所定の効果が一層確実に奏され得る。ここで言う「低アミロース小麦粉」とは、3種類のアミロース合成遺伝子Wx-A1、Wx-B1、Wx-D1のうち、何れか2種類又は全種類の発現を欠いた小麦に由来した小麦粉を指し、「糯種穀粉」とは、アミ

ロース合成遺伝子の発現を欠き、澱粉が実質的にほぼアミロペクチンのみから構成される小麦以外の穀物に由来した穀粉を指す。

低アミロース小麦粉は、例えば、日本国産の小麦品種である「つるぴかり」、「チクゴイズミ」、「ネバリゴシ」、「ニシホナミ」（以上は何れも前記3種類のアミロース合成遺伝子のうちの2種類を欠損）、「もち姫」（前記3種類のアミロース合成遺伝子の全部を欠損）の穀物穎果を製粉することによって得られる。

[0014] 前記スラリー調製工程で用いる穀粉は、典型的には、加熱等の前処理が施されていない未加工穀粉であるが、前処理を施した穀粉を用いることもできる。前記前処理としては、例えば、穀粉に各種の穀粉改質剤を添加する処理が挙げられる。前記穀粉改質剤は、穀粉を所望の性質に改質し得る剤であり、例えば、酵素、酸又はアルカリ剤、乳化剤、触媒、糖類、アミノ酸、ペプチド類、増粘多糖類等の増粘剤等が挙げられる。前記酵素としては、例えば、アミラーゼ、穀粉に含まれるタンパクを分解するプロテアーゼ等が挙げられる。

[0015] 前記スラリー調製工程では、穀粉100質量部に対し、水500～1500質量部を添加してスラリーを調製する。穀粉含有スラリーにこのような比較的多量の水を含有させることで、その後の該スラリーの乾燥工程において、穀粉に含まれる澱粉の側鎖が開きやすくなり、その結果、澱粉の老化耐性や粘弾性の向上等について、従来製法に比べて優れた効果が奏されると推察される。加水量が穀粉100質量部に対し500質量部未満では、このような本発明の所定の効果が奏されず、1500質量部を超えると、次工程のスラリー乾燥工程で固形物を得るために多くの時間及びエネルギーが必要となり、生産コストの上昇、生産効率の低下を招くおそれがある。加水量は、穀粉100質量部に対し、好ましくは600～1500質量部、より好ましくは800～1500質量部である。

[0016] 前記スラリー調製工程で調製するスラリーは、典型的には、穀粉及び溶媒としての水のみを含有するが、必要に応じ、これら以外の成分、例えば、前

記の穀粉の前処理で使用可能な穀粉改質剤を含有してもよい。その場合、1) 穀粉改質剤で前処理した穀粉を含むスラリーに、該穀粉改質剤と同じか又はこれと異なる穀粉改質剤を含有させてもよく、あるいは2) 未加工穀粉を含むスラリーに穀粉改質剤を含有させてもよい。なお、穀粉改質剤を含有するスラリーにおいては、酵素反応などの、穀粉改質剤に関わる反応が生じる場所、この反応は、該スラリーを次の乾燥工程に供する前に終了していてもよく、あるいは該乾燥工程の実施中に生じていてもよい。

[0017] 前記スラリー調製工程で調製したスラリーは、前記スラリー乾燥工程でドラムドライヤーを用いて加熱乾燥される。図1には、本発明で使用可能なドラムドライヤーの例が複数示されている。図1(a)～図1(f)はシングルドラム型、図1(g)はダブルドラム型、図1(h)はツインドラム型である。図1(a)～図1(f)は、ドラムに対する被乾燥物(スラリー)の供給方式が互いに異なり、図1(a)はスプラッシュフィード方式、図1(b)はディップフィード方式、図1(c)は下部ロール転写方式、図1(d)は上部ロールフィード方式、図1(e)はサイドロールフィード方式、図1(f)はマルチロールフィード方式である。この他に、スプレー噴霧によりドラムの外周面にスラリーを供給するスプレー方式等がある。またドラムドライヤーには、操作圧力の違いにより、常圧式、真空式がある。本発明では前記の何れの方式も使用できるが、基本構成(型式)に関しては、好ましくは図1(d)、図1(e)、図1(f)、図1(g)であり、操作圧力に関しては、好ましくは常圧式である。

[0018] 図1に示すように、ドラムドライヤーは典型的には、回転軸周りに回転可能に支持された1又は複数の円筒状のドラム1と、ドラム1の外周面1aに対向配置され、外周面1aに形成されたスラリーS(被乾燥物)の固形物を掻き取るスクレーパー2と、スクレーパー2で掻き取られた固形物を受ける受け器3とを備え、外周面1aが、スラリーSと接触してこれを加熱する加熱部として機能する。このような構成のドラムドライヤーによるスラリーの加熱乾燥は、ドラム1の内部に蒸気等の熱媒体を投入してその外周面1aを

加熱し、回転中且つ加熱状態の外周面 1 a にスラリー S を供給することで実施される。スラリー S はドラム 1 の回転中に乾燥して薄層を形成し、該薄層はスクレーパー 2 で掻き取られて受け器 3 の内部に回収される。この回収された固形物が、製造目的物の α 化穀粉である。

[0019] 前記スラリー乾燥工程における加熱条件は、使用するドラムドライヤーの構成、被乾燥物の状態等によって異なるが、本発明の所定の効果を一層確実に奏させるようにする観点から、ドラムドライヤーの加熱部の温度（ドラムの外周面の温度）は、好ましくは 100～150℃、より好ましくは 100～120℃、更に好ましくは 100～115℃である。本発明では前述したとおり、穀粉 100 質量部に対して 500 質量部以上の水を加えて多加水のスラリーを調製しており、このことが、穀粉に含まれる澱粉の側鎖が開きやすくなることに少なからず寄与し、延いては、澱粉の老化耐性や粘弾性の向上をもたらすと推察されるところ、この多加水のスラリーを、表面温度が前記の好ましい範囲に設定されたドラムドライヤーの加熱部で加熱乾燥することで、開いた澱粉の側鎖の熱による損傷を抑えつつ、高品質の α 化穀粉を製造することが可能になる。

[0020] また、本発明の所定の効果を一層確実に奏させるようにする観点から、前記スラリー乾燥工程におけるスラリーの加熱乾燥は、該スラリー乾燥工程によって得られた該スラリーの固形物（ α 化穀粉）の含水率（目標含水率）が、15 質量%以下となる条件で行うことが好ましく、より好ましくは 5～15 質量%であり、更に好ましくは 5～12 質量%、なお好ましくは 5～10 質量%である。

一般に、ドラムドライヤーでは、加熱部の温度（ドラムの外周面の温度）と被乾燥物の乾燥後の含水率（目標含水率）とが定まれば、自ずと、該加熱部への被乾燥物の供給量、ドラムドライヤーの回転速度（該加熱部と被乾燥物との接触時間）が定まる。よって、前記の加熱部の温度及び目標含水率を調整することで、被乾燥物である前記スラリーの乾燥程度を調整することができる。

[0021] 前記スラリー乾燥工程を経て得られたスラリーの固形物は、そのまま α 化穀粉として使用してもよく、粉碎して粉末にしてもよい。固形物の粉碎は、コービーミル、ジューサー等の家庭用粉碎機；ハンマーミル、ピンミル、ジェットミル等の産業用粉碎機を用いて常法に従って行うことができ、所望の粒度になるまで固形物を粉碎すればよい。

[0022] 本発明の製造方法によって製造された α 化穀粉の α 化度（糊化度）は、好ましくは90%以上、より好ましくは95%以上であり得る。このような高 α 化度の α 化穀粉を食品に配合することで、その食品の食味食感が大幅に向上し、更には食品に老化耐性が付与される。本明細書において、 α 化度とは、BAP法（ β -アミラーゼ・プルラナーゼ法）で測定された α 化度をいう。BAP法による α 化度の測定は、既報（家政学雑誌32（9），653-659，1981）に準じて、以下のとおりに実施することができる。

[0023] 〔 β -アミラーゼ・プルラナーゼ法による α 化度の測定方法〕

（A）試薬

使用する試薬は、以下のとおりである。

- 1) 0.8M酢酸-酢酸Na緩衝液
- 2) 10N水酸化ナトリウム溶液
- 3) 2N酢酸溶液
- 4) 酵素溶液： β -アミラーゼ（ナガセケムテックス株式会社、#1500S）0.017g及びプルラナーゼ（林原生物化学研究所、No.31001）0.17gを前記0.8M酢酸-酢酸Na緩衝液に溶かして100mLとしたもの。
- 5) 失活酵素溶液：前記酵素溶液を10分間煮沸させて調製したもの。
- 6) ソモギー試薬及びネルソン試薬（還元糖量の測定用試薬）

[0024] （B）測定方法

B-1) サンプル（ α 化穀粉）をホモジナイザーで粉碎し、100メッシュ以下とする。この粉碎したサンプル穀粉0.08～0.10gをガラスホモジナイザーに取る。

B-2) ガラスホモジナイザーの内容物に脱塩水 8.0 mL を加え、該ガラスホモジナイザーを 10~20 回上下させて該内容物の分散を行い、分散液を得る。

B-3) 2 本の 25 mL 容目盛り付き試験管に前記 B-2) の分散液を 2 mL ずつとり、その 2 本のうちの 1 本は、0.8 M 酢酸-酢酸 Na 緩衝液で定容し、試験区とする。

B-4) 前記 2 本のうちの他の 1 本に、1.0 N 水酸化ナトリウム溶液 0.2 mL を添加し、50℃で 3~5 分間反応させ、前記 B-2) の分散液を完全に糊化させる。その後、該他の 1 本に 2 N 酢酸溶液 1.0 mL を添加し、pH を 6.0 付近に調整した後、0.8 M 酢酸-酢酸 Na 緩衝液で定容し、糊化区とする。

B-5) 前記 B-3) 及び B-4) で調製した試験区及び糊化区の試験液をそれぞれ 0.4 mL とり、それぞれに酵素溶液 0.1 mL を加えて、40℃で 30 分間酵素反応させ、反応済液を得る。同時に、ブランクとして、酵素溶液の代わりに失活酵素溶液 0.1 mL を加えたものも調製する。酵素反応は途中で反応液を時々攪拌させながら行う。

B-6) 前記反応済液及びブランクそれぞれの 0.5 mL にソモギー試薬 0.5 mL を添加し、沸騰浴中で 15 分間煮沸する。煮沸後、流水中で 5 分間冷却した後、ネルソン試薬 1.0 mL を添加・攪拌し、15 分間放置する。

B-7) その後、前記反応済液及びブランクそれぞれに脱塩水 8.00 mL を加えて攪拌し、500 nm の吸光度を測定する。

[0025] (C) α 化度の算出

下記式により α 化度を算出する。

$$\alpha \text{ 化度 (\%)} = \{ (\text{試験液の分解率}) / (\text{完全糊化試験液の分解率}) \} \times 100$$

$$= \{ (A - a) / (A' - a') \} \times 100$$

前記式中、A、A'、a、及び a' は下記のとおりである。

A = 試験区の吸光度

A' = 糊化区の吸光度

a = 試験区のブランクの吸光度

a' = 糊化区のブランクの吸光度

[0026] 本発明の製造方法によって製造された α 化穀粉は、加工食品の製造に用いることができる。前記 α 化穀粉を加工食品の製造に用いることで、加工食品の食味食感、澱粉の老化耐性が向上し、加工食品が即席麺の場合は更に湯戻り性の向上が期待できる。ここで言う「加工食品」とは、穀粉を原料として用いて製造される二次加工食品であり、冷蔵又は冷凍食品を含む。加工食品としては、例えば、ベーカリー食品；うどん、そうめん、ひやむぎ、中華麺、パスタ、即席麺（ノンフライ含む）等の麺類；餃子の皮、焼売の皮、春巻きの皮等の麺皮類；天ぷら、から揚げ、竜田揚げ、フリッター等の揚げ物類；お好み焼き、たこ焼き、チヂミ等のホットスナック類；インスタントスープ等の粉末食品が挙げられる。前記ベーカリー食品の具体例として、パン類；ピザ類；ケーキ類；ワッフル、シュー、ビスケット、焼き饅頭等の和洋焼き菓子；ドーナツ等の揚げ菓子が挙げられる。前記パン類には、例えば、食パン（例えばロールパン、白パン、黒パン、フランスパン、乾パン、コッペパン、クロワッサン等）、調理パン、菓子パンがある。前記ケーキ類には、例えば、スポンジケーキ、バターケーキ、ロールケーキ、ホットケーキ、ブッセ、バームクーヘン、パウンドケーキ、チーズケーキ、スナックケーキ、マフィン、バー、クッキー、パンケーキがある。

[0027] 本発明の製造方法によって製造された α 化穀粉は特に、ベーカリー食品、麺類、ホットスナック類の製造に好適である。前記 α 化穀粉をベーカリー食品に用いた場合は、食感に好ましいしっとり感を付与するとともに老化耐性を向上させる効果が奏され、麺類に用いた場合は、食感に好ましい粘弾性を付与する効果が奏される。また、前記 α 化穀粉をホットスナック類に用いた場合は、当該ホットスナック類の製造直後は勿論のこと、製造後に時間が経過し、あるいは製造後に冷蔵又は冷凍保存しても、製造直後の好ましい食感

（例えば、お好み焼きであればふんわり感、たこ焼きであればとろみなど）が維持され、また、たこ焼きにおいては保形性を向上させる効果も奏される。

[0028] 前記 α 化穀粉を原料として用いる加工食品の製造方法は、当該加工食品の製造方法として公知の方法に準じたものとすることができる。例えば、ベーカリー食品の製造方法は、典型的には、前記 α 化穀粉を含む原料粉に加水して生地を調製し、該生地を必要に応じ発酵させた後、該生地を焼成する工程を有する。また、麺類の製造方法は、典型的には、前記 α 化穀粉を含む原料粉に加水して生地を調製し、該生地を麺線形状等の所定形状に成形し、必要に応じ、成形した生地を乾燥する工程を有する。ここで言う「原料粉」とは、常温常圧下で粉体の原料を指し、典型的には、穀粉（前記 α 化穀粉を含む）及び澱粉（これらを総称して「穀粉類」とも言う。）、小麦蛋白等の植物性蛋白質が含まれ、食塩、砂糖、ベーキングパウダー、油脂等の副原料は含まれない。また、ここで言う「澱粉」は特に断らない限り、小麦等の植物から単離された「純粋な澱粉」を指し、穀粉中に本来的に内在する澱粉とは区別される。

原料粉の全質量に占める α 化穀粉の含有質量の割合（以下、「 α 化穀粉占有率」とも言う。）は、加工食品の種類等に応じて適宜調整すればよく特に制限されないが、例えば、ベーカリー食品、麺類を製造する場合は、好ましくは0.5～50質量%、より好ましくは2～30質量%、さらに好ましくは5～20質量%である。

実施例

[0029] 以下、実施例により本発明をさらに詳細に説明するが、本発明は以下の実施例に限定されるものではない。

[0030] [実施例1～16、比較例1～4]

原料穀粉として未加工の小麦粉又は小麦全粒粉を用い、原料穀粉に所定量の水を加えてスラリーを調製した。前記スラリーをドラムドライヤー（シングルドラム型、カツラギ工業株式会社製）で加熱乾燥して固形物を得、該固

形物を粉砕機（レッチェ社製、超遠心粉砕機 Z M 2 0 0）で粉砕して、含水率 8 質量%の α 化穀粉（ α 化小麦粉又は α 化小麦全粒粉）を製造した。

[0031] 〔対照例 1 ～ 3〕

原料穀粉として未加工の小麦粉又は小麦全粒粉を用い、原料穀粉 1 0 0 質量部に対し水 4 0 質量部を加えて混合物を調製し、該混合物を、エクストルーダーを用いて該混合物の品温 9 5 °C を 3 分間維持する条件で加熱乾燥して固形物を得た。前記固形物を前記実施例と同様に粉砕して、含水率 8 質量%の α 化穀粉（ α 化小麦粉又は α 化小麦全粒粉）を製造した。

[0032] 前記実施例、比較例及び対照例で原料穀粉として使用した小麦粉は、次の方法で調製した。原料小麦の頤果を粉砕機（ビューラー株式会社製、テストミル）にて粉砕し、その粉砕物を上級粉、下級粉、ふすまの 3 つの画分に分け、該粉砕物の総量の 6 0 質量%が該上級粉となるように原料穀粉を調製した。前記上級粉が不足した場合は、その不足分を前記下級粉で補填した。

前記原料小麦として、「きたほなみ」、「さとのそら」、「チクゴイズミ」（以上、日本国産）、「ウエスタン・レッド・スプリング 1（1 C W）」（カナダ産）又は「ウエスタン・ホワイト（W W）」（アメリカ合衆国産）を用いた。これらの 5 種類の原料小麦のうち、「チクゴイズミ」由来の小麦粉のみが前記低アミロース小麦粉であり、それ以外の小麦由来の小麦粉は非低アミロース小麦粉である。

また、前記実施例、比較例及び対照例で原料穀粉として使用した小麦全粒粉は、日清製粉株式会社製「スーパーファインソフト」である。

[0033] 〔製造例 1：パンケーキの製造〕

前記実施例、比較例及び対照例のうちの何れか 1 種類の α 化小麦粉を 5 ～ 2 0 質量%含有し、残部が薄力粉（日清製粉株式会社製「フラワー」）である原料粉を調製した。前記原料粉 1 0 0 質量部、砂糖 2 5 質量部、ベーキングパウダー 5 質量部、サラダ油 1 0 質量部、全卵 3 0 質量部、牛乳 5 0 質量部及び適量の水を容器に入れ、それらの混合物を 1 2 0 回／分の回転数で手動にて攪拌し、品温 2 5 °C での B 型粘度計による粘度が 5 ～ 1 0 P a · s の

範囲にあるパンケーキ生地を調製した。水の添加量は、パンケーキ生地の粘度が前記範囲になるように調整した。前記パンケーキ生地の調製後に10分間の寝かし時間をとった後、グリドル上に該生地を55g流し込み、該グリドルの温度180℃で該生地の片面を3分間焼成した後、該生地を上下反転させて反対側の面を2分間焼成し、パンケーキを製造した。

[0034] [製造例2：全粒粉入りパンケーキの製造]

α 化小麦粉に代えて、前記実施例、比較例及び対照例のうちの何れか1種類の α 化小麦全粒粉を使用した以外は前記製造例1と同様にして、全粒粉入りパンケーキを製造した。

[0035] [製造例3：パンの製造]

前記実施例、比較例及び対照例のうちの何れか1種類の α 化小麦粉を10質量%、強力粉（日清製粉株式会社製「カメリヤ」）を90質量%含有する原料粉を調製した。前記原料粉100質量部、バター4質量部、砂糖6.8質量部、スキムミルク2.4質量部、食塩2質量部、ドライイースト1.1質量部をホームベーカリー（パナソニック株式会社製、商品名「SD-BM103」）に入れ、該ホームベーカリーが備える「標準コース」を選択してパンを製造した。

[0036] [製造例4：冷製茹でうどんの製造]

前記実施例、比較例及び対照例のうちの何れか1種類の α 化小麦粉を10質量%、中力粉（日清製粉株式会社製「薫風」）45質量%、アセチル化タピオカ澱粉（松谷化学工業株式会社製「あじさい」）40質量%、小麦蛋白（グリコ栄養食品株式会社製「AグルG」）5質量%を含有する原料粉を調製した。前記原料粉100質量部に、食塩3質量部を溶解した水を適量添加し、-90kPaの減圧下で混捏し麺生地を調製した。次に、麺生地を圧延し、切刃（#10番角）により厚み3mmの麺線に切り出した。次に、麺線を沸騰したお湯で茹でた後、水洗冷却し、冷却した麺線100質量部に、ほぐれ剤（不二製油株式会社製「ソヤアップM3000」）3質量部をスプレーにより均一に付着させて茹でうどんを得た。この茹でうどんを庫内温度5

℃の冷蔵庫に24時間保存して、冷製茹でうどんを製造した。

[0037] [パンケーキ、パンの評価]

製造したパンケーキ、パンを10名の専門パネラーに食してもらい、食感を下記評価基準に従って採点してもらった。1種類のパンケーキ又はパンにつき、1) 製造直後のもの、及び2) 1日間冷蔵保存したものの2種類を用意し、それぞれ評価した。前記1)は、焼成後に常温環境下で20分間放置したものである。前記2)は、焼成後、粗熱をとった後に、庫内温度4℃の冷蔵庫に1日間保存し、冷蔵庫から取り出して常温環境下で20分間放置したものである。なお前記2)の「1日間冷蔵保存」は、パンケーキ、パンの経時的な品質劣化耐性（澱粉の老化耐性）の評価を目的として、これらの劣化促進のために行ったものであり、前記2)はいわゆる加速劣化試験のサンプルである。表1、表2に、10名の専門パネラーによる採点結果の算術平均値を示す。表1の各実施例及び比較例の対照例は対照例1、表2の各実施例の対照例は対照例2である。

<パンケーキ、パンの食感の評価基準>

- 5点：対照例に比べて非常にしっとりとして柔らかである。
- 4点：対照例に比べてしっとりとして柔らかである。
- 3点：対照例に比べてややしっとりとして柔らかである。
- 2点：対照例と同等である。
- 1点：対照例に比べてパサつき及び硬さがある。

[0038] [冷製茹でうどんの評価]

冷蔵庫に保存していた冷製茹でうどんを冷蔵庫から取り出して速やかに10名の専門パネラーに食してもらい、食感を下記評価基準に従って採点してもらった。表1に、10名の専門パネラーによる採点結果の算術平均値を示す。

<冷製茹でうどんの食感の評価基準>

- 5点：対照例に比べて粘弾性に非常に優れる。
- 4点：対照例に比べて粘弾性に優れる。

3点：対照例に比べて粘弾性にやや優れる。

2点：対照例と同等である。

1点：対照例に比べて粘弾性が劣る。

[0039] 〔全粒粉入りパンケーキの評価〕

製造した全粒粉入りパンケーキを、その焼成後、粗熱をとった後に、庫内温度4℃の冷蔵庫に1日間保存し、冷蔵庫から取り出して常温環境下で20分間放置した後、適当な大きさにカットしてから10名の専門パネラーに食してもらい、食感を前記＜パンケーキ、パンの食感の評価基準＞に従って採点してもらうとともに、風味を下記評価基準に従って採点してもらった。表3に、10名の専門パネラーによる採点結果の算術平均値を示す。表3の各実施例及び比較例の対照例は対照例3である。

＜全粒粉入りパンケーキの風味の評価基準＞

5点：対照例に比べてふすま臭、エグミが非常に弱い。

4点：対照例に比べてふすま臭、エグミが弱い。

3点：対照例に比べてふすま臭、エグミがやや弱い。

2点：対照例と同等である。

1点：対照例に比べてふすま臭、エグミが強い。

[0040]

[表1]

	実施例	比較例		実施例										比較例		
		1	2	1	2	3	4	5	6	7	8	9	10	3		
α化澱粉の製造工程	原料澱粉の種類	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}		
	原料澱粉100質量部に対する加水量（質量部）	40	150	300	500	800	1000	1500	800	800	800	800	800	150		
	加水した原料澱粉の加熱乾燥機に使用した乾燥機	B	A	A	A	A	A	A	A	A	A	A	A	A		
	乾燥機A（ドラムドライヤー）の加熱部の温度（℃）	—	110	110	110	110	110	110	110	100	105	115	120	130	150	
パンケーキの食感	α化澱粉占有率10質量%	2.0	1.5	2.5	3.2	3.7	3.9	4.0	3.9	4.7	3.7	3.5	3.4	3.3	3.2	1.3
	α化澱粉占有率5質量%	2.0	1.8	2.6	3.7	4.2	4.8	4.9	4.7	—	—	4.1	3.9	3.6	3.4	1.2
	α化澱粉占有率	2.0	2.0	—	3.2	3.5	—	—	—	—	—	—	—	—	3.2	1.7
	α化澱粉占有率	2.0	1.9	—	3.3	4.0	—	—	—	—	—	—	—	—	3.3	1.8
パンの食感	α化澱粉占有率20質量%	2.0	1.5	—	3.4	4.0	—	—	—	—	—	—	—	—	3.4	1.3
	α化澱粉占有率	2.0	1.8	—	3.8	4.7	—	—	—	—	—	—	—	—	3.7	1.2
	α化澱粉占有率10質量%	2.0	1.9	—	3.3	3.9	—	—	—	—	—	—	—	—	3.2	1.7
	α化澱粉占有率	2.0	2.0	—	3.6	4.3	—	—	—	—	—	—	—	—	3.5	1.8
うどんの食感	α化澱粉占有率	2.0	1.7	—	3.9	4.5	—	—	—	—	—	—	—	—	3.6	1.4

注）乾燥機Aはドラムドライヤー、乾燥機Bはエクストルーダー
*1：非低アミロース小麦粉（きたはなみゆめ）

[0041] 表 1 に示すとおり、各実施例は、原料穀粉 100 質量部に対して 500 質量部以上の水を加えて調製したスラリーを用い、且つ該スラリーをドラムドライヤーで加熱乾燥する工程を経て α 化穀粉を製造したため、これを満たさない比較例及び対照例に比べて、加工食品（パンケーキ、パン、うどん）の食感に優れ、また、1 日間冷蔵保存したものが高評価であることから、澱粉の老化耐性にも優れ、経時的な品質劣化が抑制されたものであることがわかる。

[0042]

[表2]

		対照例	実施例				
			2	11	2	12	13
α化穀粉の製造工程	原料小麦の種類	きたほなみ	さとのそら	きたほなみ	チクゴイズミ	1 CW	WW
	原料穀粉の種類	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*1}	小麦粉 ^{*2}	小麦粉 ^{*1}	小麦粉 ^{*1}
	原料穀粉100質量部に対する加水量（質量部）	40	800	800	800	800	800
	加水した原料穀粉の加熱乾燥に使用した乾燥機	B	A	A	A	A	A
	乾燥機A（ドラムドライヤー）の加熱部の温度（℃）	-	110	110	110	110	100
パンケーキの食感	α化穀粉占有率 10質量%	製造直後 （5点満点）	3.4	3.7	4.1	3.6	3.5
		1日間冷蔵保存 （5点満点）	3.6	4.2	4.9	3.9	3.7

注) 乾燥機 A はドラムドライヤー、乾燥機 B はエクストルーダー
* 1 : 非低アミロース小麦粉
* 2 : 低アミロース小麦粉

[0043] 表2に示すとおり、 α 化穀粉の原料穀粉として低アミロース小麦粉を用いた実施例12は、低アミロース小麦粉を用いていない他の実施例に比べて、食感及び澱粉の老化耐性に優れていた。

[0044] [表3]

			対照例	比較例	実施例	
			3	4	15	16
α 化穀粉の製造工程	原料穀粉の種類		小麦全粒粉	小麦全粒粉	小麦全粒粉	小麦全粒粉
	原料穀粉100質量部に対する加水量（質量部）		40	150	500	800
	加水した原料穀粉の加熱乾燥に使用した乾燥機		B	A	A	A
	乾燥機A（ドラムドライヤー）の加熱部の温度（℃）		-	110	110	110
1日間冷蔵保存パンケーキの食感	α 化穀粉占有率10質量%	食感（5点満点）	2.0	2.0	3.6	4.4
		風味（5点満点）	2.0	2.6	4.2	4.9

注）乾燥機Aはドラムドライヤー、乾燥機Bはエクストルーダー

[0045] 表3に示すとおり、各実施例は、原料穀粉100質量部に対して500質量部以上の水を加えて調製したスラリーを用い、且つ該スラリーをドラムドライヤーで加熱乾燥する工程を経て α 化穀粉を製造したため、これを満たさない比較例及び対照例に比べて、加工食品（パンケーキ）の食感及び澱粉の老化耐性に優れ、更には、原料穀粉として小麦全粒粉を使用したにもかかわらず、不快なふすま臭、エグミが十分に低減されていた。

産業上の利用可能性

[0046] 本発明によれば、食味食感が良好で、経時劣化耐性に優れる二次加工品を製造可能な α 化穀粉が提供される。

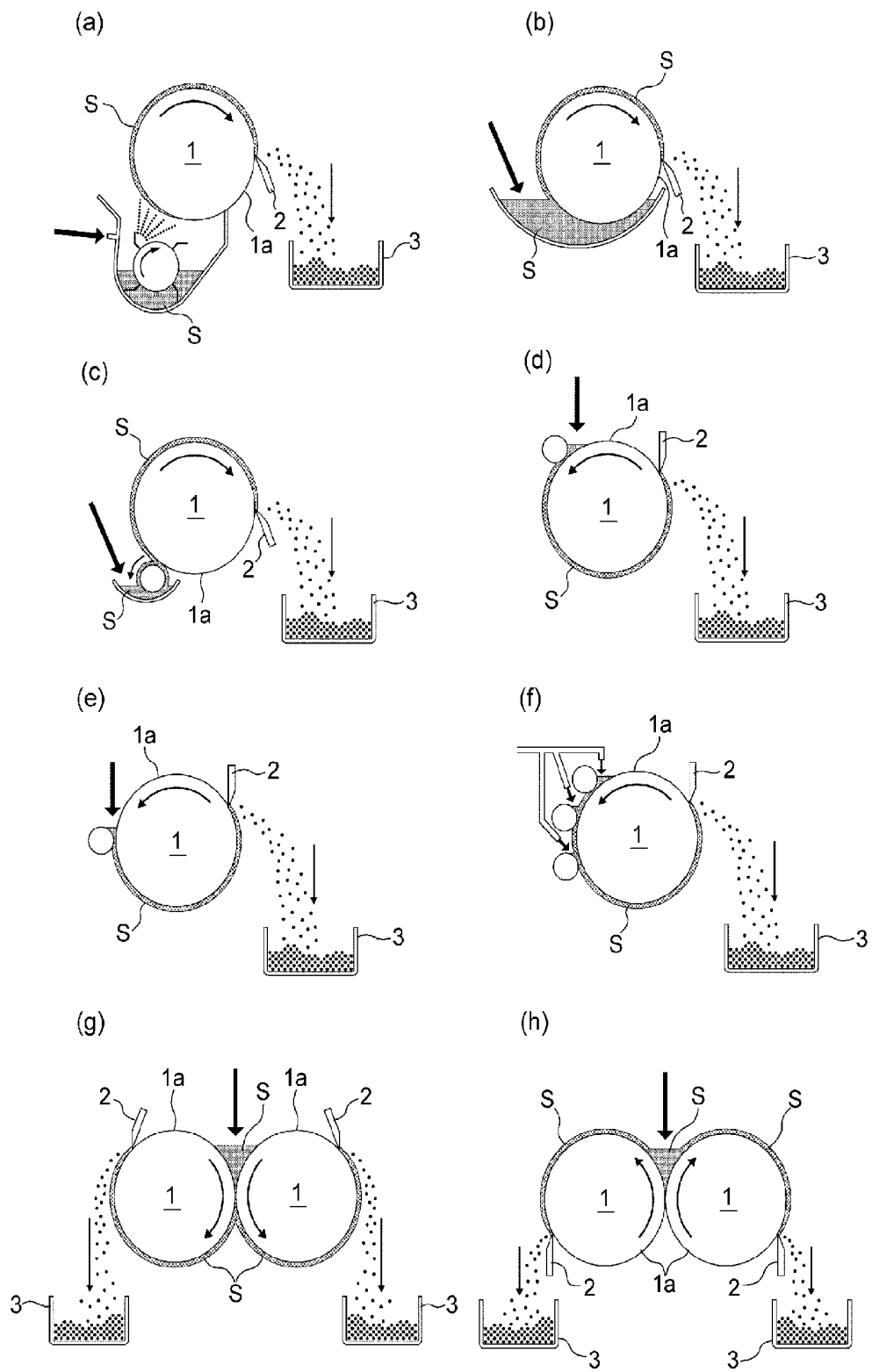
より具体的には、例えば、本発明によって提供される α 化穀粉をベーカリー食品の製造に用いた場合は、ふんわりと柔らかく、しっとり感、もちり感のあるベーカリー食品が得られ、また、麺類の製造に用いた場合は、粘弾性に優れ食感が良好な麺類が得られ、しかも何れの場合も、その良好な食味食感が長期間にわたって維持され得る。また、本発明によって提供される α 化穀粉が全粒粉を原料とする α 化全粒粉である場合には、全粒粉中のふすまに起因する特有の臭みやエグミが低減され、且つ前記の優れた効果を奏し得

る二次加工品を製造することができる。

請求の範囲

- [請求項1] 穀粉100質量部及び水500～1500質量部を含むスラリーをドラムドライヤーで加熱乾燥する工程を含む、 α 化穀粉の製造方法。
- [請求項2] 前記穀粉は小麦粉を含む、請求項1に記載の α 化穀粉の製造方法。
- [請求項3] 前記穀粉は、低アミロース小麦粉及び糯種穀粉から選択される1種以上を含む、請求項1又は2に記載の α 化穀粉の製造方法。
- [請求項4] 前記ドラムドライヤーの加熱部の温度は100～150℃である、請求項1～3の何れか1項に記載の α 化穀粉の製造方法。
- [請求項5] 請求項1～4の何れか1項に記載の製造方法で製造された α 化穀粉を原料として用いる、加工食品の製造方法。

[図1]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/018797

A. CLASSIFICATION OF SUBJECT MATTER**A23L 7/10**(2016.01)i; **A21D 2/18**(2006.01)i; **A21D 13/00**(2017.01)i; **A21D 13/44**(2017.01)i; **A23L 7/109**(2016.01)i

FI: A23L7/10 Z; A21D2/18; A21D13/00; A21D13/44; A23L7/109 C

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)

A23L7/10; A21D2/18; A21D13/00; A21D13/44; A23L7/109

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2022

Registered utility model specifications of Japan 1996-2022

Published registered utility model applications of Japan 1994-2022

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

JSTPlus/JMEDPlus/JST7580 (JDreamIII)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	YANG, Meng-Ting et al. Study on the Physicochemical Properties and Ready-to-eat Characteristics of Wheat Flour with Different Treatment of Drum Drying (Pregelatinized), J. Agri. & Fore., 2011, 60(3), pp. 181-197 in particular, p. 182, left column, 2nd paragraph to p. 183, left column, 1st paragraph	1-2, 4-5
Y		3-5
Y	JP 2018-64489 A (NISSHIN FLOUR MILLING CO., LTD.) 26 April 2018 (2018-04-26) paragraphs [0009], [0010]	3-5
X	JP 59-48060 A (NISSHIN FLOUR MILLING CO., LTD.) 19 March 1984 (1984-03-19) p. 3, example 3	1-2, 4-5
X	SIRIKONG, P. et al. Physico-Chemical Properties of Pregelatinized Mung Bean Flour by Drum Drying and Extrusion Process. Proceedings of The IRES 30th International Conference, 2016, pp. 55-60 in particular, p. 56, left column, 2nd paragraph from the bottom, p. 59, left column, 1st paragraph	1, 4-5



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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“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

12 July 2022

Date of mailing of the international search report

26 July 2022

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915
Japan

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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/018797

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SOISON, Bisri et al. Physico-functional and antioxidant properties of purple-flesh sweet potato flours as affected by extrusion and drum-drying treatments. <i>International Journal of Food Science and Technology</i> , 2014, 49, pp. 2067-2075 in particular, p. 2067, 1st paragraph, p. 2068, left column, 2nd paragraph from the bottom, right column, 2nd paragraph	1, 4-5

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2022/018797

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP	2018-64489	A	26 April 2018	(Family: none)	
JP	59-48060	A	19 March 1984	(Family: none)	

A. 発明の属する分野の分類（国際特許分類（IPC）） A23L 7/10(2016.01)i; A21D 2/18(2006.01)i; A21D 13/00(2017.01)i; A21D 13/44(2017.01)i; A23L 7/109(2016.01)i FI: A23L7/10 Z; A21D2/18; A21D13/00; A21D13/44; A23L7/109 C		
B. 調査を行った分野 調査を行った最小限資料（国際特許分類（IPC）） A23L7/10; A21D2/18; A21D13/00; A21D13/44; A23L7/109 最小限資料以外の資料で調査を行った分野に含まれるもの 日本国実用新案公報 1922-1996年 日本国公開実用新案公報 1971-2022年 日本国実用新案登録公報 1996-2022年 日本国登録実用新案公報 1994-2022年		
国際調査で使用した電子データベース（データベースの名称、調査に使用した用語） JSTPlus/JMEDPlus/JST7580 (JDreamIII)		
C. 関連すると認められる文献		
引用文献の カテゴリー*	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する 請求項の番号
X	YANG, Meng-Ting et al., Study on the Physicochemical Properties and Ready-to-eat Characteristics of Wheat Flour with Different Treatment of Drum Drying (Pregelatinized), J. Agri. & Fore., 2011, 60(3), pp.181-197 特にp.182の左欄第2段落-p.183の左欄第1段落	1-2, 4-5
Y		3-5
Y	JP 2018-64489 A (日清製粉株式会社) 26.04.2018 (2018-04-26) [0009] - [0010]	3-5
X	JP 59-48060 A (日清製粉株式会社) 19.03.1984 (1984-03-19) 第3頁実施例3	1-2, 4-5
X	SIRIKONG, P. et al., PHYSICO-CHEMICAL PROPERTIES OF PREGELATINIZED MUNG BEAN FLOUR BY DRUM DRYING AND EXTRUSION PROCESS, Proceedings of The IRES 30th International Conference, 2016, pp.55-60 特にp.56左欄下から第2段落、p.59左欄第1段落	1, 4-5
☒ C欄の続きにも文献が列挙されている。 ☒ パテントファミリーに関する別紙を参照。		
* 引用文献のカテゴリー “A” 特に関連のある文献ではなく、一般的技術水準を示すもの “E” 国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの “L” 優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す） “O” 口頭による開示、使用、展示等に言及する文献 “P” 国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献 “T” 国際出願日又は優先日後に公表された文献であって出願と抵触するものではなく、発明の原理又は理論の理解のために引用するもの “X” 特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの “Y” 特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの “&” 同一パテントファミリー文献		
国際調査を完了した日 12.07.2022		国際調査報告の発送日 26.07.2022
名称及びあて先 日本国特許庁(ISA/JP) 〒100-8915 日本国 東京都千代田区霞が関三丁目4番3号		権限のある職員（特許庁審査官） 澤田 浩平 40 3338 電話番号 03-3581-1101 内線 3461

C. 関連すると認められる文献

引用文献の カテゴリ*	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する 請求項の番号
X	SOISON, Bisri et al., Physico-functional and antioxidant properties of purple-flesh sweet potato flours as affected by extrusion and drum-drying treatments, International Journal of Food Science and Technology, 2014, 49, pp. 2067-2075 特にp. 2067第1段落、p. 2068左欄下から第2段落、右欄第2段落	1, 4-5

国際調査報告
パテントファミリーに関する情報

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引用文献			公表日	パテントファミリー文献	公表日
JP	2018-64489	A	26.04.2018	(ファミリーなし)	
JP	59-48060	A	19.03.1984	(ファミリーなし)	