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[54] **RENDERING COOKER**

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[51] **Int. Cl.**.....**A47j 27/52**

[58] **Field of Search**.....259/109, 110, 175, 176, 177, 259/178; 99/234, 235, 348; 260/412.6; 318/8, 11; 23/253, 290.5

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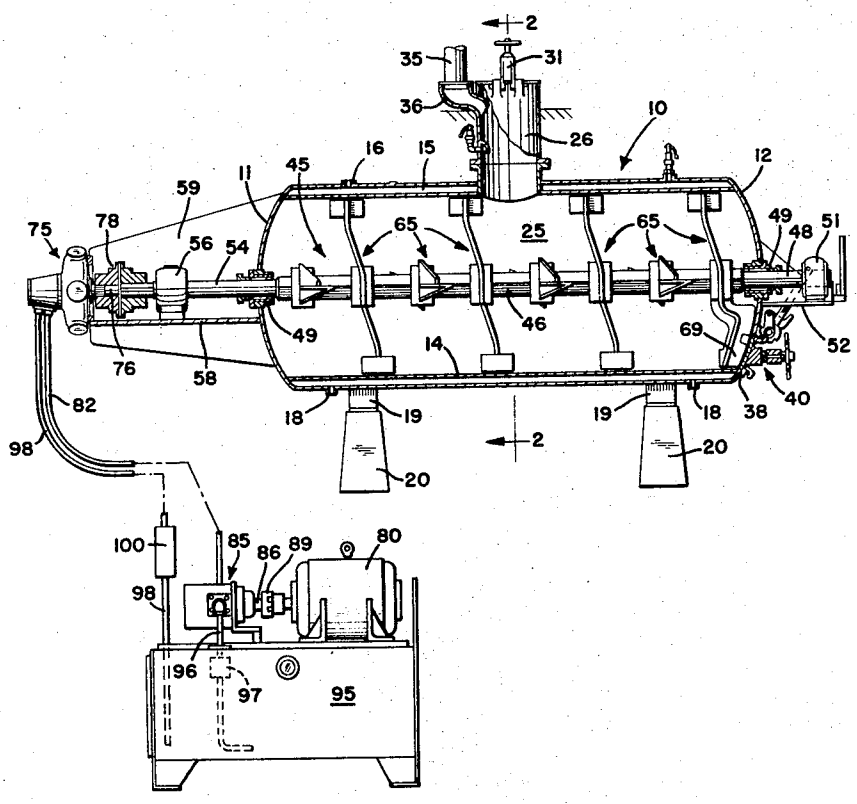
Primary Examiner—Robert W. Jenkins

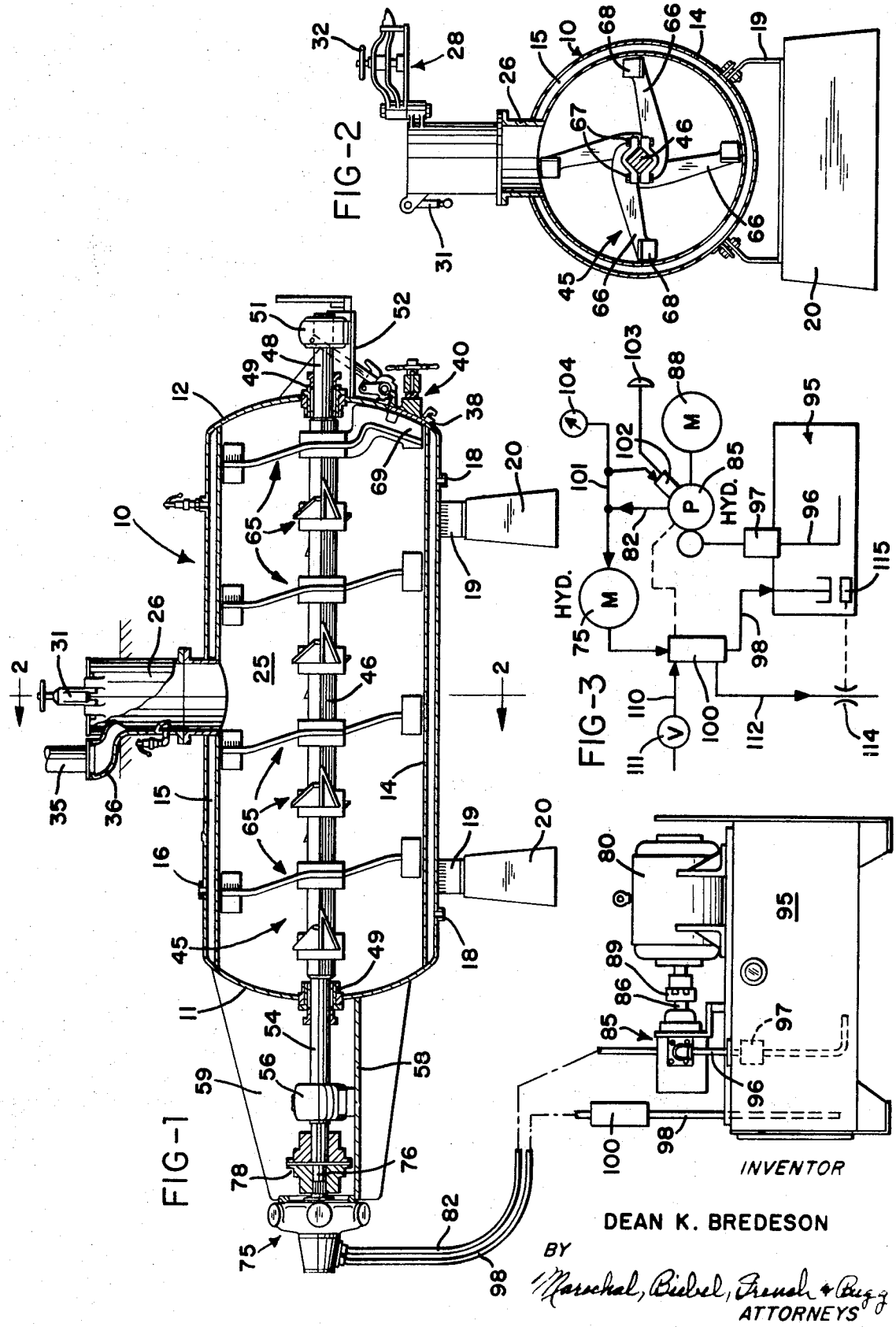
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[57] **ABSTRACT**

A material is rendered within a heated vessel or container which encloses a rotary agitator including a shaft driven by a hydraulic motor. Hydraulic fluid is supplied to the motor at a substantially constant pressure so that the motor transmits a substantially constant horsepower to the agitator shaft to effect an automatic increase in the rotational speed of the agitator when the required torque decreases and a decrease in speed when the torque increases.

6 Claims, 3 Drawing Figures




FIG-1
FIG-2
FIG-3
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RENDERING COOKER

BACKGROUND OF THE INVENTION

In the rendering of a material which changes consistency as it is being heated, as for example, in the rendering of poultry by-products such as offal and feathers, commonly the material is processed in batches within a horizontal cooker. The cooker consists of an elongated cylindrical vessel or container having an upper charging inlet and a bottom discharge outlet and defining a chamber adapted to receive a heating fluid such as steam. An agitator is disposed within the container and includes an axially extending shaft which supports a plurality of paddle assemblies. The agitator shaft is rotatably supported at each end of the container and is connected at one end to a chain drive extending from a gear reducer driven by a constant speed electric motor.

During the rendering of a batch of material such as poultry by-products, the horsepower required to drive the agitator quickly increases as the cooker is charged with material. For example, in one installation, the power required increased to **50** horsepower when a batch was supplied to the cooker. Within approximately one-half hour, the load dropped to about 60 percent of the 50 horsepower or to approximately 30 horsepower. After a cooking period of about 2½ hours, the load began to increase again to a level above the initial load or to about 60 horsepower as the by-products approach the "glue" or "stick" phase of the rendering process. During the next period of approximately one hour, the load dropped to approximately 60 percent of the initial feed load or about 30 horsepower until the batch of material is ready to be discharged.

The electric motor for driving the agitator is selected so that its maximum power output corresponded to the power required to drive the agitator during the "glue" phase of the cooking operation. Thus in the above example, a motor was selected to produce a maximum of 60 horsepower at a speed of 38 rpm which was held constant during the entire cooking process.

It has been determined that the time required for cooking the material can be significantly reduced by increasing the speed of the agitator which effectively increases the rate of evaporation of moisture from the material as it is being cooked and/or dehydrated. However, to rotate the agitator shaft at a higher constant speed and to provide the necessary torque during the "glue" phase, requires the selection of a motor having a significantly higher horsepower and a substantially higher cost.

SUMMARY OF THE INVENTION

The present invention is directed to the rendering of a material in a more efficient manner by automatically increasing the rotational speed of the agitator when the torque required to rotate the agitator decreases and decreasing the speed of the agitator when the torque increases. In accordance with one embodiment of the invention, this rendering technique is performed automatically within a rendering cooker having an agitator driven by a hydraulic motor. Hydraulic fluid is supplied to the motor from a pump which is driven by an electric motor, and the pressure of the hydraulic fluid is maintained substantially constant by a closed loop control system so that the horsepower transmitted from the hydraulic motor to the agitator shaft remains substantially constant. Thus when the torque required to drive the agitator shaft decreases during the cooking process as the viscosity of the material decreases, the rotational speed of the agitator increases to effect an increase in the rate of evaporation of moisture from the material and thereby decrease the overall time required for rendering the material.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** shows a horizontal rendering cooker driven by a hydraulic drive system in accordance with the invention;

FIG. **2** is a vertical section taken generally on the line **2—2** of FIG. **1**; and

FIG. **3** is a schematic of the hydraulic control system for the cooker drive shown in FIG. **1**.

Referring to FIG. **1**, a horizontal rendering cooker includes a cylindrical shell **10** having dome-like end walls **11** and **12**. A cylindrical inner wall **14** cooperates with the shell **10** to define a cylindrical or annular chamber **15**. Hot fluid such as steam is supplied to the chamber **15** through one or more inlets **16** and is discharged from the chamber through bottom outlets **18**. The shell **10** is supported by brackets **19** which mount on corresponding pedestals or bases **20**.

The inner cylindrical wall **14** and the end walls **11** and **12** cooperate to define a cooking chamber **25** which is adapted to receive a charge or batch of material to be rendered through an inlet duct **26** projecting upwardly from the shell **10**. A cover **28** is pivotally connected to the duct **26** by a vertical pin **29** and is movable between an open position (FIG. **2**) and a closed position (FIG. **1**) where the cover is clamped and sealed to the inlet duct **26** by a latch **31** and a clamping screw **32**. A vent pipe **35** is connected to the inlet duct **26** by a fitting **36** and is connected to a valve (not shown) for controlling a pressure build-up within the cooking chamber **25**. The vent pipe **35** may also be connected to a suction pump to provide a partial vacuum in the chamber **25** if desired for rendering a particular material. A discharge outlet **38** is formed within the lower portion of the end wall **12** and receives a door **40** pivotable between an open position (not shown) and a closed position (FIG. **1**) where a fluid tight seal is formed between the door and the end wall **12**.

A rotary agitator or agitating assembly **45** is disposed within the chamber **25** and includes a axially extending shaft **46** having a square cross-sectional configuration. A cylindrical shaft **48** extends from one end of the shaft **46** through a packing gland **49** and is rotatably supported by a bearing **51** mounted on a bracket **52** secured to the end wall **12** of the container. A cylindrical shaft **54** extends from the opposite end of the agitator shaft **46** through a corresponding packing gland **49** mounted on the end wall **11** and is rotatably supported by a bearing **56** mounted on a platform **58** secured to the end wall **11**. A pair of side reinforcing plates **59** are secured to the edges of the platform **58** and also to the end wall **11** of the container to form a rigid cantilevered bracket.

A plurality of paddle assemblies **65** are mounted on the square shaft **46** at axially spaced intervals, and each paddle assembly **65** includes a pair of diametrically op-

posed paddle arms **66** (FIG. **2**) which are clamped to the shaft **46** by a set of bolts **67**. A paddle plate **68** is secured to the outer end of each paddle arm **66** and is angled slightly relative to the axis of the shaft **46** to effect circulation of a material within the chamber **25** when the agitator is rotated. The paddle assembly **65** adjacent the end wall **12** also includes a wiper blade **69** which aids in discharging material through the outlet **38**.

In accordance with the present invention, the shaft **54** of the agitator **45** is driven by a hydraulic motor **75** which is mounted on the outer end of the platform **58**. The motor **75** has an output shaft **76** which is connected to the shaft **54** through a flexible coupling **78**. One make of hydraulic motor which has provided satisfactory performance is Double A Staffa model B200 sold by Scott Equipment Company, Dayton, Ohio. This hydraulic motor is of the fixed displacement radial piston type having a maximum recommended speed of 175 rpm and a maximum continuous torque of 7350 foot pounds to produce a maximum horsepower rating of approximately 160 hp.

Hydraulic fluid is supplied to the motor **75** through a conduit or line **82** which is connected to a hydraulic pump **85** having an input shaft **86** connected to the output shaft of an electric motor **88** through a flexible coupling **89**. One hydraulic pump which has been determined to be satisfactory for driving the hydraulic motor **75** is a **24** series axial piston hydraulic pump with a constant horsepower control sold by Sunstrand. This pump is capable of producing a hydraulic pressure of 5000 psi and sufficient flow rate to drive the shaft **76** of the hydraulic motor **75** at a speed range of 0 to 65 rpm. This hydraulic pump was driven by a 75 horsepower, 1800 rpm electric motor having a 1.15 service factor.

As shown in FIG. **1**, the hydraulic pump **85** and the electric motor **88** are mounted on a reservoir tank **95** adapted to receive hydraulic fluid which is supplied to the hydraulic pump **85** through a supply line **96** having a filter **97**. The fluid is returned to the tank **95** from the motor **75** through a return line **98** which extends through a heat exchanger **100**. Referring to FIG. **3**, the hydraulic pump **85** is capable of maintaining a substantially constant pressure within the supply line **82** so that the hydraulic motor **75** will transmit to the agitator shaft **54** a substantially constant horsepower. This is accomplished through a closed loop recirculating system including a fluid line **101** which connects the fluid supply line **82** to a pressure regulator **102** mounted on the hydraulic pump **85**. The regulator is adjustable by a hand control knob **103** to change the pressure within the supply line **82**, and a pressure gage **104** is connected to the line **101** to facilitate the selection of the fluid pressure within the line **82**. If the hydraulic pressure within the supply line **82** begins to increase above a preselected value, as for example, 3100 psi, fluid is recirculated to the pump **85** through the line **101** and the pressure regulator **102**.

As mentioned above, the fluid return line **98** from the hydraulic motor **75** to the reservoir tank **95** extends through a heat exchanger **100** so that the temperature of the hydraulic fluid does not exceed a predetermined upper limit during the operation of the cooker. The heat exchanger **100** is supplied with cooling water through a line **110** having a flow control valve **114** which is regulated in response to a temperature sensing element **115** located within the reservoir tank **95**. As the temperature of the hydraulic fluid increases, the valve **114** opens further to increase the flow rate of cooling water from the supply line **110** through the heat exchanger **100**.

From the drawings and the above description, it is apparent that a rendering cooker having an agitator driven in accordance with the invention provides desirable features and advantages. For example, by driving the agitator shaft **54** with a motor which produces a substantially constant horse-power, the agitator **45** automatically increases in speed as the torque required to rotate the agitator decreases and decreases in speed when the required torque increases. As a result, when the consistency or viscosity of the material being rendered decreases, and the torque required to drive the agitator decreases, the speed of the agitator automatically increases thereby increasing the rate of moisture removal or evaporation from the material as it is being cooked and/or dehydrated. This significantly reduces the overall time required for rendering a batch of material thereby enabling successive batches of material to be rendered more efficiently at a faster rate.

The hydraulic drive system for driving the agitator shaft **54** is especially desirable in that it provides an economical drive means for transmitting substantially constant horsepower to the drive shaft **54**. For example, once the pressure of the hydraulic fluid in the supply line **82** is selected with the control knob **103**, this pressure will remain substantially constant to the hydraulic motor **75** causing the motor to produce a substantially constant horsepower output.

While the apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. An improved cooker adapted for rendering a material which changes in consistency while being cooked, comprising a container, a rotatable agitator disposed within said container and having a shaft projecting therefrom, means for heating the material within said container, a hydraulic motor connected to said shaft of said agitator, and means including a regulated constant pressure fluid supply to said motor for automatically controlling said motor to effect a substantially constant horsepower transmission from said motor shaft to said agitator shaft for providing a more efficient cooking operation.

2. An improved cooker adapted for rendering a material which changes in consistency when it is heated, comprising a container, a rotatable agitator disposed within said container and having a shaft, means for heating the material within the container, a hydraulic motor having a shaft connected to said shaft of said agitator, a pump connected to supply hydraulic fluid to said motor, and means for controlling said motor to maintain a substantially constant pressure fluid supply to said motor to effect an automatic increase of the rotational speed of said agitator when the torque required to rotate said agitator decreases and an

automatic decrease in the rotational speed of the agitator when the torque required to rotate said agitator increases for providing a more efficient cooking process.

3. A cooker as defined in claim 2 wherein said hydraulic motor has a shaft aligned with said shaft of said agitator, and coupling means connecting said shafts.

4. A cooker as defined in claim 2 wherein the controlling means includes an adjustable regulator for changing the pressure of the hydraulic fluid supplied to said motor from said pump to effect a change in the horsepower transmitted to said agitator shaft.

5. A cooker as defined in claim 2 wherein said controlling means includes a fluid line connecting said fluid supply to said motor, pressure sensing means connected to said fluid line, and said pressure sensing means is effective when the pressure of said fluid supply increases above a preselected value to cause fluid to be recirculated from said fluid line to said pump to maintain said substantially constant pressure.

6. A cooker as defined in claim 2 including a reservoir, a fluid return line connecting said motor to said reservoir, and means for cooling the fluid in said return line in response to the temperature of the fluid in said reservoir.

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