Oct. 19, 1943. A. P. HOLLY 2,331,910

PRESSURE-COOKER DISCHARGE DEVICE

Filed June 13, 1941 2 Sheets-Sheet 1

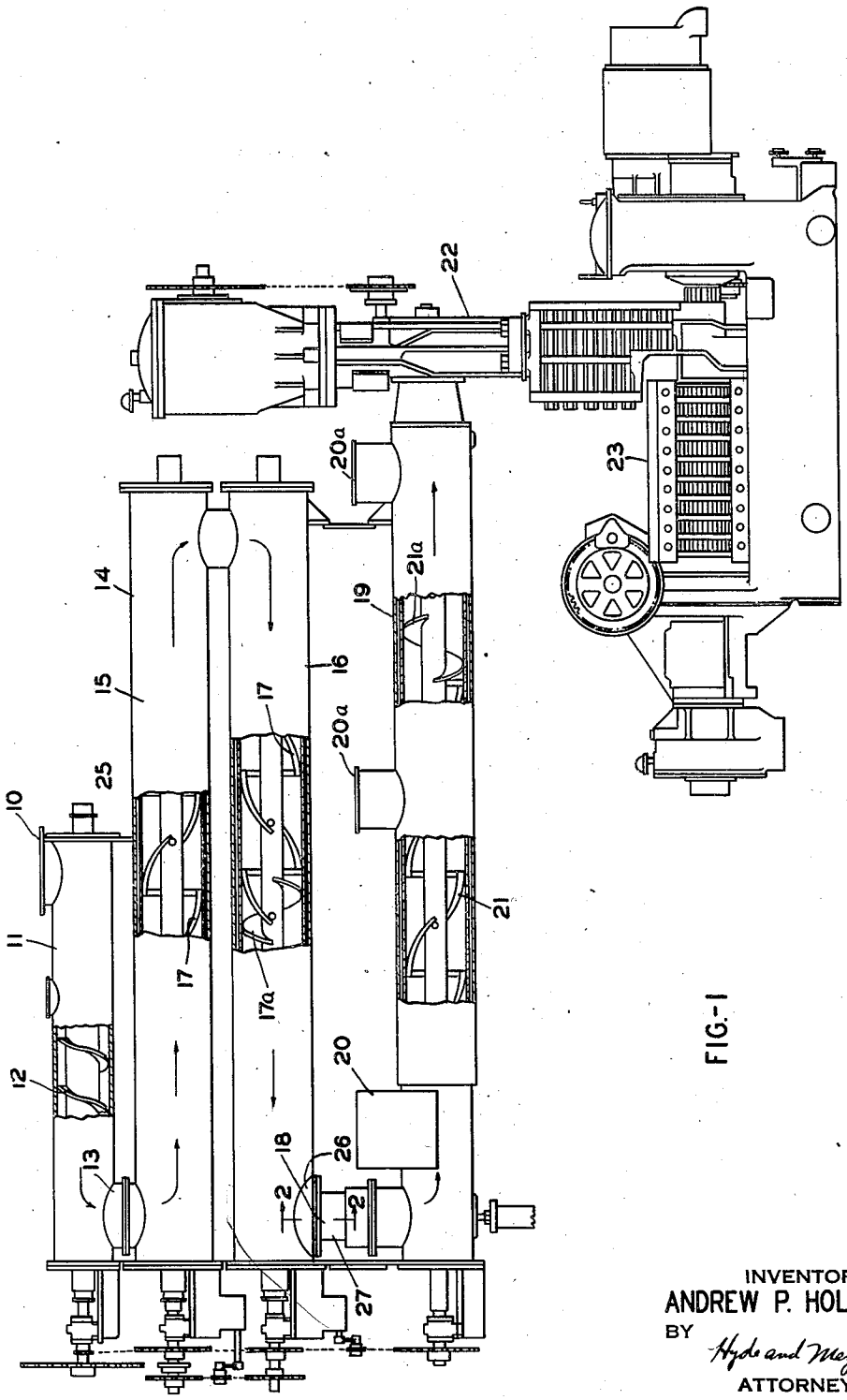


FIG.-1

INVENTOR
ANDREW P. HOLLY
BY Hyde and Meyer
ATTORNEYS

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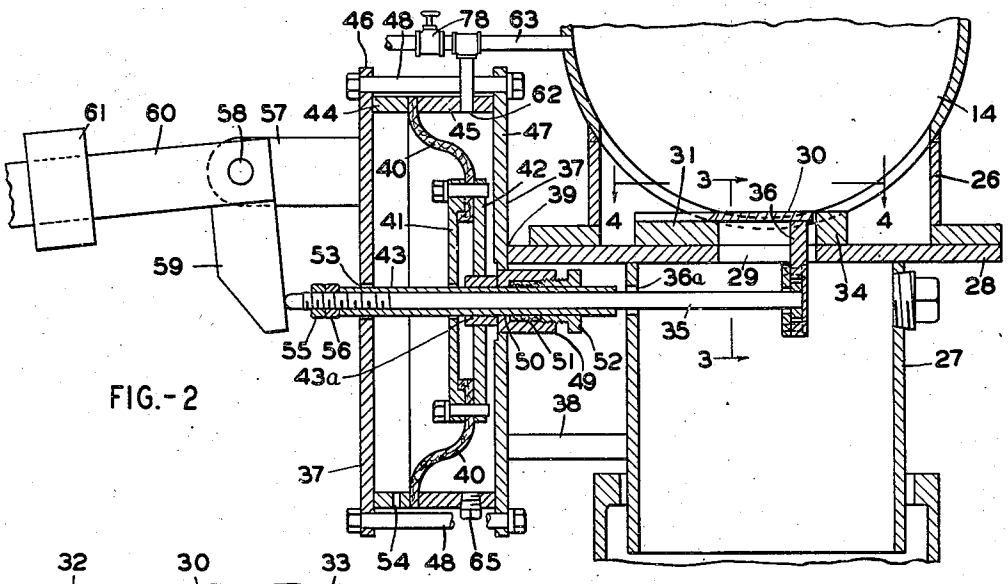


FIG.-2

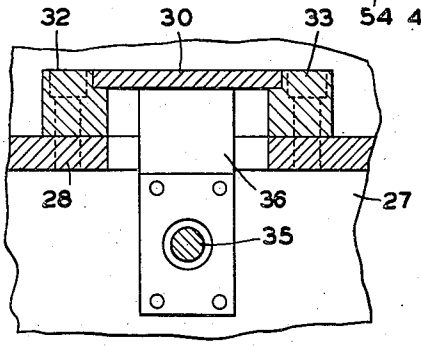


FIG.-3

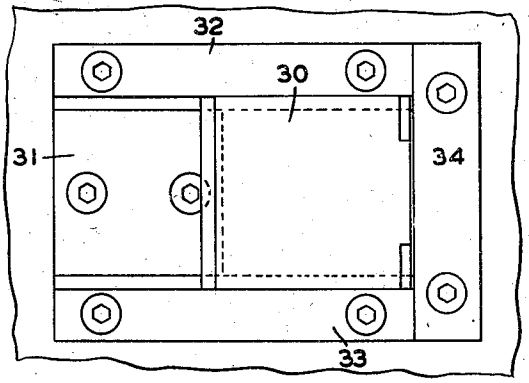


FIG.-4

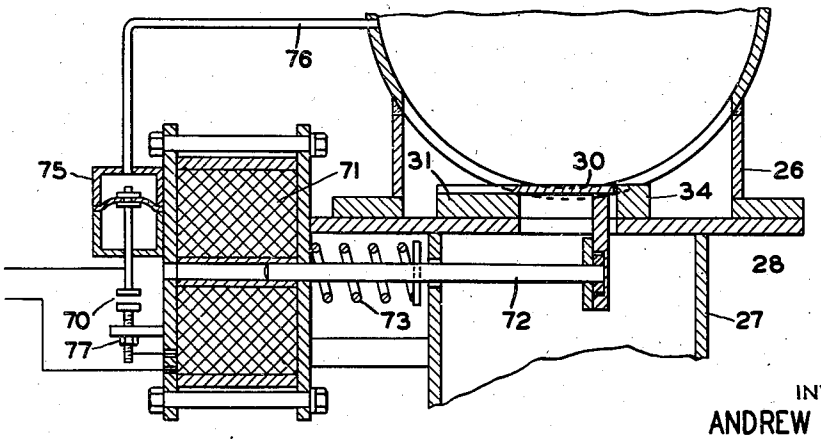


FIG.-5

INVENTOR
ANDREW P. HOLLY
BY Hyde and Meyer
ATTORNEYS

Patented Oct. 19, 1943 2,331,910

UNITED STATES PATENT OFFICE

2,331,910

PRESSURE-COOKER DISCHARGE DEVICE

Andrew P. Holly, Memphis, Tenn., assignor to The V. D. Anderson Company, Cleveland, Ohio, a corporation of Ohio

Application June 13, 1941, Serial No. 397,940

2 Claims. (Cl. 23—290)

The invention relates to apparatus for processing oil bearing materials of animal or vegetable origin whereby certain oils and usable solid by-products are recovered therefrom. It is particularly directed to novel and improved valve means for regulating the flow of materials through chambers where the oil bearing materials are subjected to heat and pressure preparatory to the oil extracting step. As will appear, my improved valve means controls the pressure, usually maintained in such chambers, within a desired predetermined range, and simultaneously regulates the advance of the material from this pressure chamber either to the oil extracting press or to further chambers where the material may be suitably conditioned before the oil is actually extracted.

An object of the invention is the provision of valve means sensitive to variations in pressure in a treating chamber for permitting continuous progression of material through said treating chamber, while maintaining the pressure within a predetermined range.

While, as will appear, my improved valve means is adaptable to more general application, I have chosen to illustrate and describe it in connection with an oil press of the general type disclosed in the Anderson United States Patent No. 1,971,632, and will discuss it as applied to a pressure cooker for the treatment of cottonseed oil preparatory to the oil expressing step.

It is well known to those skilled in the art, and therefore not discussed at great length herein, that oil expressing processes of the type mentioned can be maintained at high efficiency only by very carefully controlling certain factors such as temperature, pressure, humidity, etc., and that failure to maintain the process within critical limits not only results in variations in the percentage yield of oil, but also may result in a deterioration in the quality of both the oil, and the solid by-product. It is further known, still referring particularly to the extraction of cottonseed oil, that relatively elevated temperatures to which the seed is subjected prior to pressing, in order to give an efficient yield, may induce certain harmful organic developments in both the oil and the cake unless the temperature is closely controlled. It is nevertheless desirable, in order to decrease the length of the operative cycle, that the seed be brought up to temperature rapidly and that this temperature be maintained rather closely. It has been found that ideal conditions are realized, for example in expressing cottonseed oil, when the seed is maintained for a brief period under a pressure of, say, two or three pounds pressure above atmospheric, developed when the material is cooked in a steam-jacketed container, or pressure cooker.

Commercial efficiency requires that this be done as part of a continuous process and my present invention relates to improved discharge valve means whereby the appropriate pressure range may be maintained while the material is carried through the cooker and discharged through said valve, the valve operating means being sensitive to variations of pressure in the cooking chamber, and being suitably operated to permit periodic or continuous discharge of material from the chamber.

While the valve now to be described may be arranged to close completely when the pressure in the cooking chamber drops below a certain predetermined point, and to open again when the pressure subsequently rises above said point, I prefer to adjust the valve so that, in normal operation, it remains in partially opened position. This permits a continuous discharge of material, modulated or controlled to the extent that any rise in pressure tends to move the valve so as to increase the cross sectional area of the discharge opening, and a drop in pressure reverses this tendency so as to move the valve towards closed position. Under preferred, normal operation the material issues from the cooking chamber in a continuous jet. It is apparent that under conditions such as above described a state of equilibrium will rapidly be reached between the various factors including, principally, temperature, pressure, and supply and discharge of material.

Before the present invention is described in detail, it is to be understood that such invention is not limited to the details of construction and/or the specific arrangement of parts herein illustrated and/or described, as the invention obviously may take other forms. It also is to be understood that the phraseology or terminology herein employed is for the purpose of description and not of limitation.

The invention will be described in connection with the accompanying drawings, in which

Fig. 1 is a view in elevation of one form of mechanism embodying the present invention and illustrating such features of a pressure cooker, a conditioning unit, and an extractor press as are necessary for a proper appreciation of the invention.

Fig. 2 is a sectional view, somewhat enlarged, taken on the line 2—2 of Fig. 1.

Fig. 3 is a section taken on the line 3—3 of Fig. 2.

Fig. 4 is a section taken on the line 4—4 of Fig. 2.

Fig. 5 is a view similar to Fig. 2 but showing somewhat different valve operating means.

Referring first generally to the main structural features of the invention, Fig. 1 shows, in section, an oil press such as is disclosed in the aforesaid Anderson patent, but equipped with improved apparatus for pressure cooking and conditioning the material in a continuous process as more fully described in Patent No. 2,269,898, granted January 13, 1942 to Raymond T. Anderson for Treatment of oleagnious material.

In said improved construction the material is first charged into a feed hopper 10 whence it is advanced through a feed chamber 11 by means of a succession of worm flights 12, and simultaneously compressed both by a decrease in pitch of the screw flights and a decrease in the total cross sectional area of the passage, as now familiar to those skilled in the art.

At the end of the feed chamber the material, in a now somewhat compacted condition, passes through an inlet opening 13 into a pressure cooker 14 which may be of any suitable design but is here shown as having an upper cooker section 15 and a lower cooker section 16 which are respectively successively traversed by the material in the direction indicated by the arrows under the impelling influence of sectional feed screws comprising a plurality of successive agitating flights 17 and conveyors 17a designed to agitate and advance the material towards the discharge valve 18, said valve being the subject of the present invention, which will later be more fully described.

In the cooker the material is subjected to heat and pressure. The heat may conveniently be applied by steam jacketing the cooker. By this means, and as a natural result of the vaporization of the moisture content of the material, the pressure rapidly builds up beyond atmospheric unless controlled in some way, for instance in the manner to be described. The material may also be subjected to the heating and sterilizing action of jets of live steam, which treatment also tends to increase the pressure in the chamber.

When material is released from the pressure cooker by said discharge valve, in a manner soon to be explained, it is conveyed, in the present exemplification, through a conditioner 19, the purpose of which is to thoroughly agitate the material and deliver it to the press under uniform conditions of temperature, consistency, and humidity. The conditioner is vented to the atmosphere by means of an exhaust duct 20 and vents 20a to permit escape of steam or other vapors entering the conditioner from the cooker.

When the material has been carried through the conditioner, preferably by agitator flights 21 and conveyor flights 21a, it is discharged into the feed chute 22 of the press and thence is advanced to the main press 23, as more fully disclosed in the aforesaid Anderson Patent No. 1,971,632.

This general sequence of the progress of the material through the feeder, the cooker, and the conditioner, has been somewhat briefly outlined to make plain the function, manner of operation, and specific construction of the discharge valve 18 which constitutes a control element in the outlet between the cooker and the conditioner. As the description proceeds it will be apparent that this improved discharge valve, and manner of control and operation thereof, may be adapted to uses other than those specifically illustrated and described, which uses involve a discharge control for pressure vessels of various types. To clearly explain the operation of the invention I have shown in Fig. 1 an actual operating assembly but it will be obvious that the feeder or the conditioner may be eliminated, or that other elements may be substituted therefor or appended thereto without materially affecting the principle of operation or essential construction of the valve.

As soon as the operative elements shown in Fig. 1 are put in operation, and material is supplied to the feeder, the friction between the feeder casing and the material compressed by the feed screw is sufficient in the present embodiment to close the inlet 13 to the cooker with a "cork" of compressed material, the sealing effect at the said inlet being sufficient to hold moderate pressures of the type herein contemplated, namely, not in excess of about two atmospheres. The discharge outlet 18 will now be described, with special reference to Figs. 2, 3, and 4.

The lower portion of the outlet end of the cooker is provided with a discharge passage which in the present embodiment is divided into an upper cylindrical section 26 and a lower cylindrical section 27. A plate 28 is firmly secured between said upper and lower sections, and has a centrally perforated portion 29 provided with a laterally sliding valve member 30. As heretofore indicated, in normal operation the valve is not intended to close the discharge opening completely, but only to serve as a modulating control, to offset variations in pressure in the cooker by increasing or decreasing the cross sectional area of the discharge opening. As will appear, however, the construction is such that the valve may be adjusted to completely close the opening, if desired, and thereafter to alternately open and close the discharge opening to compensate for pressure changes, and permit what might be termed intermittent operation.

A slide support 31 carries grooved runway members 32 and 33 (Fig. 3) to guide the lateral movement of the valve slide, and endwise movement of the slide is stopped at fully closed position by slide stop 34, and at fully open position by abutment of a downwardly extending portion 36 of the slide 30 with slide support 31.

The valve 30 is operated by a push rod 35 attached to said downwardly extending portion 36 of the valve slide. The push rod extends through an oversized aperture 36a in the lower cylindrical housing 27, and is reciprocally actuated by a power device 37 as follows. The power device shown in Fig. 2 includes a fluid pressure cylinder 37 attached to the lower portion of the cooker in any suitable manner, such as by bracket 38, and by additional securement to the end of plate 28 at 39. Within the cylinder is a movable abutment, in the form of a flexible diaphragm 40 secured between face plates 41, 42, plate 42 being attached to push rod sleeve 43 at 43a. Plate 41 is readily removable for repair or replacement of the diaphragm, the outer edge of which is gripped between annular members 44, 45 which are held in compression by end plates 46, 47 and retaining bolts 48. End plate 47 of the housing carries a perforated bushing 49 which provides a bearing for endwise reciprocation of sleeve 43, the sliding fit between bushing and sleeve at 50 being sealed by pack-

ing washers 51 and packing gland 52. End plate 46 is provided with an oversize aperture 53 which permits free reciprocation of the push rod sleeve 43 and also vents the diaphragm to atmosphere on one side thereof. A suitable trap or aperture may be provided at 54 to prevent condensation from building up on the atmospheric pressure side of the diaphragm and interfering with predetermined factors which control the operation thereof as will appear.

The outer end of the push rod 35 is suitably threaded to carry adjusting means such as lock nuts 55, 56, it being apparent that endwise adjustment of rod 35 with relation to sleeve 43 may be obtained by movement of said nuts along the threaded portion of the rod. Under normal operational conditions I prefer to adjust the nuts 55, 56 so as to maintain the valve in slightly open position, but it is apparent that it may also be adjusted to permit complete closure of the opening, the operation thereafter being intermittent until a re-adjustment is made.

A bracket 57 carried by the housing has pivotally mounted thereon, at 58, a bell crank lever having an abutment arm 59 and a counterweight lever arm 60. Arm 59 abuts the end of push rod 35 and it is apparent that by changing the position of counterweight 61 on arm 60, the force tending to maintain the push rod 35 and sleeve 43 in the position shown in Fig. 2 may be increased or decreased as desired.

The annular wall 45 of the cylinder is perforated at 62 for connection thereto of a fluid pressure conduit 63, the other end of which communicates directly with the pressure chambers of cooker 10.

Said annular wall may also be provided with a drain plug 65. In actual operation I prefer to fill the space on the pressure side of the diaphragm with water, which conveniently serves to transmit pressure while protecting the diaphragm against the possible harmful effect of continuous contact on one surface with live steam. The water may be added through a fitting 78 in the pressure line 63.

The operation of the valve 30 and its manner of control of the discharge outlet of the cooker are as follows. To start the operation material is charged into feeder 11 and, as heretofore mentioned, the material is advanced toward the passage 13 between the feeder and the cooker and compressed so as to provide a moving "cork" or seal for said passage. On entering the cooker the material is simultaneously sterilized by jets of live steam, then further heated by contact with the steam jacketed walls, and rapidly advanced through the upper and lower cooking chambers toward the discharge opening 18. Irrespective of the position of the leading surface of the material, as soon as the pressure resulting from the heat and the steam jets builds up to a point where the pressure through conduit 63 on diaphragm 40 exceeds the force exerted on push rod 35 by bell crank arm 59 as determined by the setting of counterweight 61, the diaphragm will move to the left (Fig. 2) carrying with it sleeve 43, and, through abutment of the sleeve against lock nuts 55, 56 the valve rod 35 will also move to the left, causing slide 30 to enlarge the discharge opening 18. Pressure in the cooker drops as the valve opens and as soon as it falls below that amount necessary to raise the counterweight lever the valve will again tend to close.

In this arrangement the slide valve 30, together with the operating mechanism therefor, is of particular and desired advantage from several standpoints. In the first place, it is self-cleaning and unlikely to get out of order in service by the collection on the valve or its seat of fragments or masses of solid material being processed. As the valve moves back and forth it constantly frees itself and the seat on which it slides of any material which otherwise might remain there. Moreover, the weight of the material in the cooking container exerts no effect whatever upon the valve tending to move it toward either open or closed position, quite contrary to the effect when the valve is of pivoted or swinging form. The weight of the material does no more than hold the valve to its seat. Therefore, the only duty imposed upon the valve operator (in this case the motor diaphragm and the weighted lever) is to move the valve back and forth. Therefore, it is extremely sensitive to small variations in the pressure above atmospheric within the cooking vessel and the pressure to be maintained in the vessel, as determined by the position to which the weight 61 is adjusted, is maintaned fairly uniform within close limits. Because valve motion is unaffected by the weight of the material resting on the valve, the pressure in the container is not affected by variations in the quantity of charge of material in the container.

When the material being simultaneously agitated and advanced through the cooker arrives at the discharge valve it is forced out through the opening both by the pressure transmitted through the material and derived from the worm flights, and also by the outrushing pressure of escaping steam. This novel and improved construction therefore permits continuous, modulated travel of material into, through, and out of a pressure processing chamber, while maintaining control over the pressure and the rate of entry and discharge of material.

In its broadest concept the invention comprises means sensitive to slight pressure variations in a chamber for controlling a discharge valve so as to permit travel of material through the chamber. I have already disclosed one embodiment having as the operative element a power device with direct pressure coupling to the chamber, the sliding valve operated thereby being free of any tendency to move, resulting from gravity effect of the material resting on the valve. Various other embodiments will occur to those skilled in the mechanical arts after a consideration of the above described device. Another embodiment is shown in Fig. 5 of the accompanying drawings, wherein the fluid pressure operated device 75 need not be powerful enough to operate the valve directly, but need only be adequate to open and close a relay, including the switch points 70 which control the flow of line current to an operating solenoid 71. Solenoid 71 actuates the valve push rod 72, corresponding to rod 35 in Fig. 2, and as before valve 30 is a slidable valve. While the solenoid is deenergized the valve is biased to closed position by the spring 73. The device may be adjusted to operate at various basic pressures by varying the adjustment of one of the points 70, for instance by the adjusting nut 77. In the embodiment shown in Fig. 5, the motor cylinder 75 is directly connected to the pressure cooker by conduit 76. When the pressure in the cylinder builds up to a predetermined point, switch 70 is closed and solenoid 71 is energized so as to move push rod 72 to valve-open position, thereby reducing the pressure towards valve-closing value as aforesaid.

It is apparent that a valve control of this latter type will come to rest in one of two extreme positions, usually corresponding to fully open and fully closed, although mechanical stops might be provided, by means not shown, which would affect this operation. Such open-and-shut mode of operation, generally termed "hunting," does not result in as high a degree of accuracy in pressure control as does the modulating valve type first disclosed hereinabove where the valve action is "floating" rather than "hunting."

What I claim is:

1. Apparatus of the character described, comprising a container wherein solid proteinaceous material is treated under pressure, heating means therefor, said container being provided with a material supply opening and with a discharge passage, a slidable plate form valve member movable to closed and open positions for sealing and unsealing said passage, and means sensitive to the pressure within said container for actuating said valve member.

2. Apparatus of the character described, comprising a container wherein proteinaceous material is treated under pressure, heating means therefor, said container being provided with a material supply opening with a discharge passage, a slidable plate form valve member for sealing and unsealing said passage movable in a plane transverse to the direction of movement of the material leaving the container by way of said discharge passage, and means including a power device sensitive to variations in pressure in the container for actuating said slidable valve member.

ANDREW P. HOLLY.