United States Patent [19]

Retrum

[11] **3,830,150**

[45] **Aug. 20, 1974**

[54] **FEATHER CRUSHER COMPACTOR**

[75] Inventor: **Rowland Retrum,** St. Louis, Mo.

[73] Assignee: **Ralston Purina Company,** St. Louis, Mo.

[22] Filed: **Dec. 18, 1972**

[21] Appl. No.: **316,387**

[52] **U.S. Cl.** **99/467,** 99/483, 99/494, 99/516, 241/82.7

[51] **Int. Cl.** **A22c 21/00**

[58] **Field of Search** 99/467, 483, 494, 516; 23/290, 290.5; 241/82.1, 82.3, 82.7

[56] **References Cited**

UNITED STATES PATENTS

695,878	3/1902	Geiger et al.	241/82.7
833,422	10/1906	Shaw	241/82.7
3,475,178	10/1969	Zebarth et al.	99/494 X

FOREIGN PATENTS OR APPLICATIONS

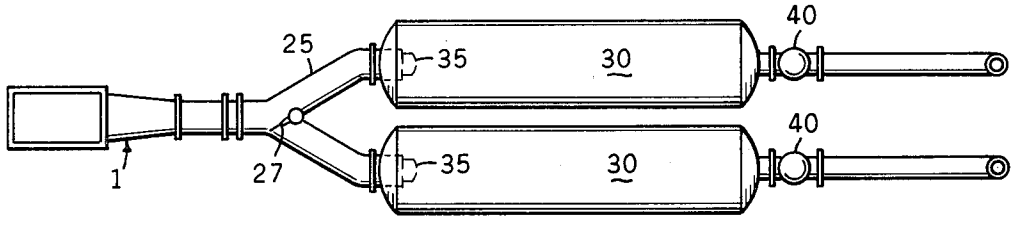
6,704	2/1902	Austria	241/82.7
62,938	6/1892	Germany	241/82.7
23,426	0/1897	Great Britain	241/82.7

Primary Examiner—Stanley N. Gilreath
Attorney, Agent, or Firm—Lawrence J. Hurst; W. Dennis Drehkoff

[57] **ABSTRACT**

Apparatus for crushing materials selected from the group of feathers, poultry offal and combinations thereof is disclosed wherein a housing is provided having a plurality of splines about the outlet end thereof defining a plurality of openings through which a compression screw may force the material. A cutter is provided on the discharge end of the compression screw serving to uniformly crush or break up the material as it is forced through the openings defined by the splines and the compression screw. Additionally, the crusher apparatus may be incorporated into a semi-continuous hydrolyzing system. The crushed material as discharged from the continuous crusher is selectively fed to one of the batch type hydrolyzing units attached to the exit end of the crusher. The material is maintained in one of the hydrolyzer units for the hydrolysis process while a second hydrolyzer unit is being charged and discharged with the material.

2 Claims, 4 Drawing Figures



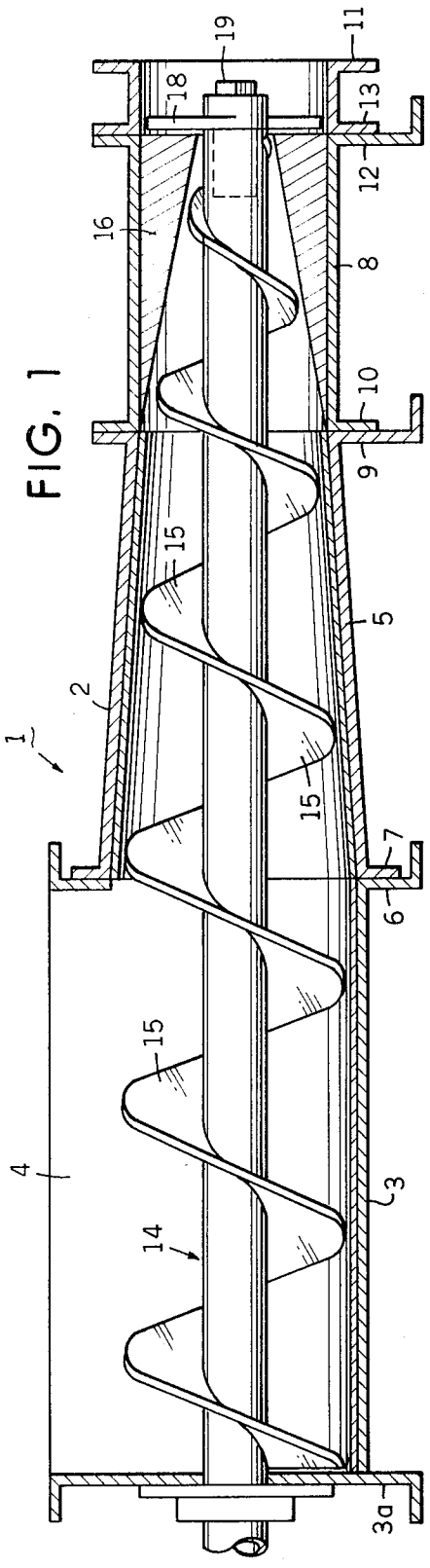


FIG. 1

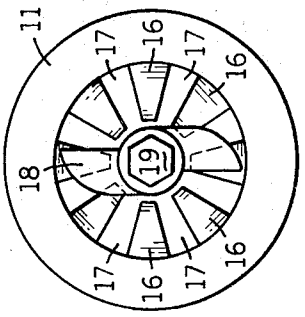


FIG. 2

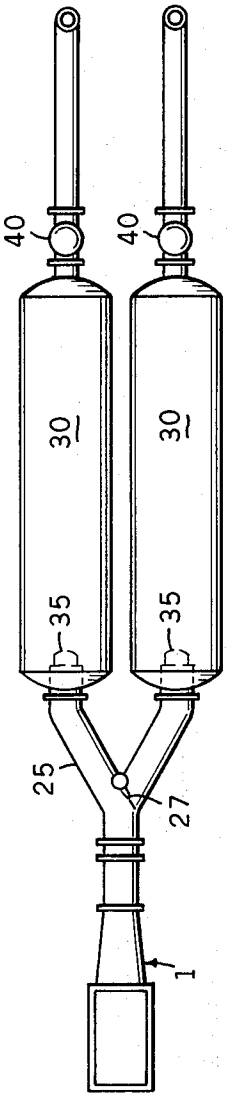


FIG. 3

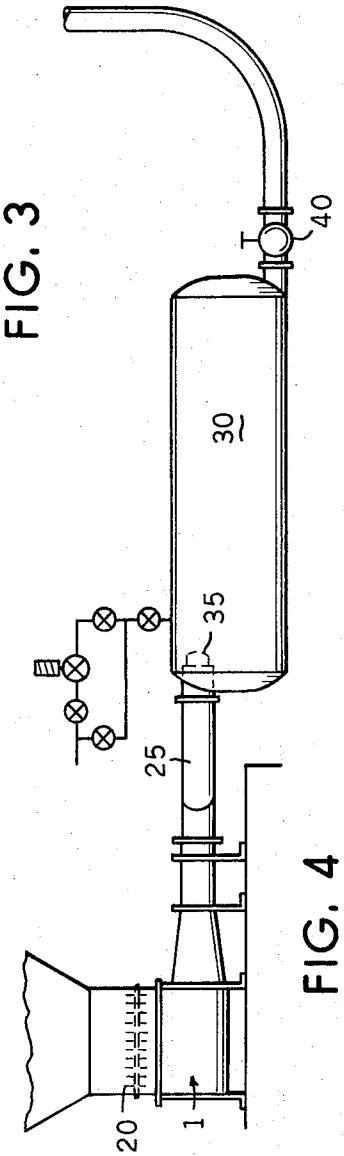


FIG. 4

FEATHER CRUSHER COMPACTOR

BACKGROUND OF THE INVENTION

The subject invention is concerned with a unique apparatus which may suitably be used for crushing or reducing material selected from the group of feathers, poultry offal and combinations thereof prior to a hydrolyzing operation. The material crusher is particularly useful for crushing or reducing in size feathers and combinations of feathers and offal although satisfactory results may be obtained when merely offal is passed through the present apparatus.

In prior art apparatus, feathers as well as offal were merely placed into a hydrolyzing unit and subjected to the hydrolyzing process. However, when utilizing whole feathers, the variation of sizes between quills and the fine feather end, inhibited or prevented a uniform hydrolysis of the feathers. Further, the quill portion of the feather was not broken such that hydrolysis of the interior portion of such quills could not be satisfactorily attained.

Other prior art devices have attempted to provide the feathers in a more usable condition for use in the hydrolyzing system. Particularly, U.S. Pat. No. 3,617,313 discloses a hydrolyzing system wherein the feathers are compacted to serve as a pressure plug and are then subjected to a breaking action which serves to break off chunks or plugs of the feathers for the subsequent hydrolyzing process. However, this apparatus by merely breaking off chunks or plugs of the feathers does not effectively crush or reduce the size of feathers in a uniform manner. By crushing feathers in the subject apparatus in a uniform manner it is possible to obtain improved hydrolysis characteristics of the feathers. Additionally, the subject apparatus may be utilized not only for the hydrolysis of feathers but may also be utilized for crushing or reducing the size of poultry offal or on an offal and feather combination. Such offal or offal and feather combinations do not lend themselves to satisfactorily produce a pressure plug as disclosed and required in U.S. Pat. No. 3,617,313.

Further, the apparatus of the subject invention is of a simplified construction which may be easily modified depending upon the type of material to be processed and is also adaptable for incorporation into a semi-continuous hydrolyzing system.

The crusher apparatus may be attached to standard hydrolyzer units, preferably two such units with a diverter valve selectively controlling the flow of crushed material from the crusher apparatus to the hydrolyzer units. In this manner when one of the hydrolyzer units is supplied with a desired quantity of crushed material, the diverter valve is then activated to supply the crushed material to another of the hydrolyzer units as the hydrolyzing process is carried out in the first hydrolyzer unit. By utilizing the crusher apparatus in such an arrangement, the crusher apparatus is not working against a back pressure or serving to form a pressure plug but rather is merely providing the crushed material to the hydrolyzer units, desirably under atmospheric conditions. As one of the hydrolyzer units is being charged and discharged with material, the other of the hydrolyzer units may be utilized for carrying out the hydrolysis process such that the arrangement provides a simple and economic method of semi-

continuously hydrolyzing feathers, offal, and/or feather and offal combinations.

Briefly, the present invention is directed to a crusher apparatus which comprises a housing having an inlet and an outlet for receiving and discharging material; a compression screw is provided in the housing between the inlet and outlet having flights thereon which pass in close proximity to the housing, diminishing toward the discharge end in diameter and in pitch, for moving the material from the inlet to the outlet; means are provided in the housing adjacent to the outlet thereof for converging material toward the flights of the compression screw; said means and the housing define a plurality of openings through which the material is compressed and forced to the outlet; and a cutter is provided on the outlet end of the compression screw adjacent to the means for converging material, serving to crush or sever the material as it is forced from the openings by the compression screw. Another aspect of the present invention is an arrangement wherein the crusher apparatus is selectively connected to hydrolyzer units, permitting the semi-continuous hydrolysis of the material.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of the crusher apparatus of the present invention;

FIG. **2** is an end view of the crusher apparatus of FIG. **1**;

FIG. **3** is a top view of the crusher apparatus of the present invention as utilized in a continuous hydrolyzing system; and

FIG. **4** is a side view of the hydrolyzing system of FIG. **3**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. **1**, the crusher apparatus, indicated generally at **1**, is provided with a housing **2**. The housing **2** is provided with an inlet housing portion **3** having a hopper or inlet opening **4** provided therein. A tapered housing portion **5** of the housing **2** is connected to the housing portion **3** by the flanges **6** and **7**. The other end of the tapered housing portion **5** is connected to the housing **8** by the flanges **9** and **10**. The housing **8** is also connected to an annular outlet or discharge portion **11** by the flanges **12** and **13**. These flanges may be connected by any suitable means such as bolts or welds. It should be noted that the end wall member and flange **3A** of the housing portion **3** and flanges **6, 9** and **12** provide supports for attaching the crusher apparatus **1** to a suitable base.

A compression screw indicated generally at **14** is mounted through the end wall **3A** of the housing portion **3** and extends from the inlet opening **4** into the annular housing portion **11**. The compression screw **14** is connected by suitable means to a standard variable speed drive (not shown) preferably for rotating the screw at 30 – 90 rpm although other speeds may be utilized depending upon the type of material processed and the size of the crusher apparatus **1**. It should be noted that the compression screw **14** is provided with flights **15** which are predeterminately decreasing in diameter and pitch from the inlet opening **4** to a point adjacent to the discharge end of the compression screw **14**. The flights **15** of the screw **14** pass in close proximity to the housing portions **4** and **5** serving to urge the

material from the inlet opening 4 toward the discharge or outlet end 11.

The housing portion 8 is provided with a plurality of tapered splines 16 which progressively converge toward the compression screw 14 adjacent the discharge end of said screw. The splines 16 may be attached to the housing 8 by any suitable means, such as welds. It should be understood that the plurality of splines 16 serve to define with the housing 8 a plurality of openings 17 through which the material to be crushed may be compacted and discharged. The number of splines 16 provided in the housing 8 will depend on the operator's preference and the size of the material desired to be obtained, however, very satisfactory results have been obtained when eight splines were equally spaced around a housing approximately 15 inches in diameter to define eight equal openings. A cutter member 18 is provided on the discharge end of the compression screw 14 by suitable means such as the bolt 19. It should be understood that the alternative areas defined by the splines 16 serve to form anvils and relief areas for the cutter 18 such that the cutter may effectively crush or break up feathers and/or offal as they are discharged through the openings 17 defined between the splines 16.

In the operation of the apparatus 1 raw feathers and/or offal are supplied through the inlet opening 4 with the compression screw 14 rotating at a desirable speed. The feathers and/or offal are carried along by the flights 15 on the compression screw 14 through the tapered housing area 5 and into the housing section 8 wherein the feathers and/or offal are converged or compacted by the tapered splines 16 into the openings 17 defined therebetween. The tapered splines 16 as well as the changing pitch of the flights 15 of the compression screw 14 serve to compact and force the feathers and/or offal through the opening 17 defined by the splines 16. As the compression screw 14 is rotated, the cutter 18 is driven thereby at a constant rate of speed and as the feathers and/or offal exit from the openings 17 the cutter 18 is effective to break up and crush the feathers and/or offal in a uniform manner. Desirably the cutter 18 will be provided with two cutting edges such that adequate relief may be obtained between each of the blocks of feathers and/or offal as they are discharged from the openings 17. However, depending upon the size of the crusher apparatus and of the speed of rotation of the cutter, other blade arrangements may be suitably utilized for obtaining the desired crushing characteristics.

Referring now to FIGS. 3 and 4 it will be seen that the crusher apparatus of FIG. 1 is provided with a metering feed device, indicated generally at 20, which serves to feed the feathers and/or offal in a uniform manner to the crusher. The discharge end of the crusher 1 is connected to a bifurcated pipe member or conduit 25 which has the bifurcated portions thereof connected to hydrolyzer units 30. These hydrolyzer units are comprised of pressure vessels well known in the art and commercially available. Interposed in the conduit 25 is a diverter valve 27 which may either be manually or automatically controlled and which serves to selectively control or direct the feathers and/or offal as discharged from the crusher 1 into either of the hydrolyzers 30 as the operator desires. It should also be understood that more than two hydrolyzers could be connected to the crusher 1, however, two such hydrolyzer units would be the preferred arrangement. Each of the ends of the bifurcated conduit 25 are provided with check valves 35 which serve to maintain the pressure in the hydrolyzer 30 during the hydrolysis process when the crushed feathers and/or offal are not being supplied thereto. Additionally, it should be noted that each of the hydrolyzers 30 is provided with a valve 40, manually or automatically controlled, in the discharge conduit from the hydrolyzer which also serves to maintain the desired pressure in the hydrolyzer during the hydrolysis process. When one of the hydrolyzer units 30 is filled with material and the standard hydrolysis operation is being performed therein, the diverter valve 27 is actuated to control the flow of material into the other hydrolyzer unit 30. As is well known in the art, the hydrolysis operation is then conducted in the filled or loaded hydrolyzer unit 30, under elevated temperature and pressure. When the hydrolysis operation is completed the valve 40 is opened which allows the elevated pressure in the hydrolyzer unit 30 to discharge the material into a cooker or intermediate drier for treatment as is well known in the art. Such a cooker may either be continuous or batch type, depending on the operator's preferance. Desirably, the cooker will be of the batch type and sized to permit the hydrolyzed material to be completely dried without the necessity of using a drier. However, if desired a drier such as a rotary steam tube dryer may be used following the cooker or intermediate dryer. As is obvious by using the arrangement such as shown in FIGS. 3 and 4, the crusher 1 is not utilized as a means of forming the pressure plug for the hydrolyzing system and also is not acting against the pressure which is established in the hydrolyzers 30 during the hydrolysis process. In this manner the feathers and/or offal may be more readily moved by the compression screw 14 through the openings 17 defined by the splines 16. Further, such an arrangement permits the operator to utilize the crusher in the hydrolyzing of combinations of materials which would not be suitable for forming a pressure plug for a continuous hydrolyzer system. Particularly, the subject apparatus is useful for the hydrolyzing of a combination of poultry offal and feathers wherein the feathers may be crushed or broken up by a cutter 18 and the offal does not adversely affect the pressure seal which is formed by the check valves 35 in the hydrolyzers 30. In this manner the crusher 1 may be suitably operated not only for preparing hydrolyzed feather meal but also for preparing combination meals wherein feathers and offal are subjected to the hydrolysis process, as well as meal made from offal alone. Additionally, it should be understood that by using batch hydrolyzer units in this manner it is possible to process material in small segments over a period of time such that only small ancillary equipment is required for treating the effluents and odiferous emissions which are discharged with the material. This is possible since customary batch processing techniques utilize large hydrolyzer units for processing large volumes of material whereas in the present process only relatively small quantities of material will be processed in each of the hydrolyzer units 30. It is contemplated that the quantity of material supplied to and processed in each of the hydrolyzer units 30 will be determined such that as the hydrolysis operation is being performed in one of the hydrolyzer units 30 the other hydrolyzer units will be discharging the material to the cooker and then be filled with material. In this manner

when one unit is being emptied and filled, the other unit is performing the hydrolysis operation so that the crusher unit **1** and hydrolyzer units **30** operate in a semi-continuous batch system. Thus, even though the same quantity of material is being processed, by using the semi-continuous system disclosed herein, the ancillary equipment is only required to handle a small portion of the effluents and odiferous emissions at any one time.

However, it should be understood that if desired the feather crusher **1** could be utilized in such a manner that the feathers as they were forced through the openings **17** defined by the tapered splines **16** form a pressure fluid seal permitting the discharge of the feathers directly into a hydrolyzer unit. This would be accomplished by providing a sufficient quantity of feathers to the hopper **4** such that the flights **15** of the compression screw **14**, when compacting the feathers through the tapered housing portion **5** and also in the housing **8** with the tapered splines, forms the desired pressure seal.

In view of the foregoing, it is now apparent that applicant has disclosed a novel crusher apparatus meeting the objects and advantages heretofore set forth and that obvious modifications and changes may be made in the injection apparatus without departing from the spirit of the invention.

I claim:

1. Apparatus for semi-continuously hydrolyzing materials comprising means for breaking up the material to be hydrolyzed, a pair of batch hydrolyzer units, a conduit connecting each of the hydrolyzer units to the means for breaking up material, a valve in said conduit for selectively controlling the flow of material from said means to said hydrolyzer units, each of said hydrolyzer units having means for maintaining elevated temperatures and pressures therein during the hydrolysis of the materials.

2. The apparatus according to claim **1** wherein the means for breaking up the material comprises a housing having an inlet and an outlet, a plurality of tapered splines mounted in said housing about the outlet thereof, the tapered splines defining therebetween and with said housing a plurality of openings, a compression screw in said housing for moving material from said inlet to said outlet through said openings and a cutter on said compression screw for breaking up said material as it is forced through said openings.

* * * * *