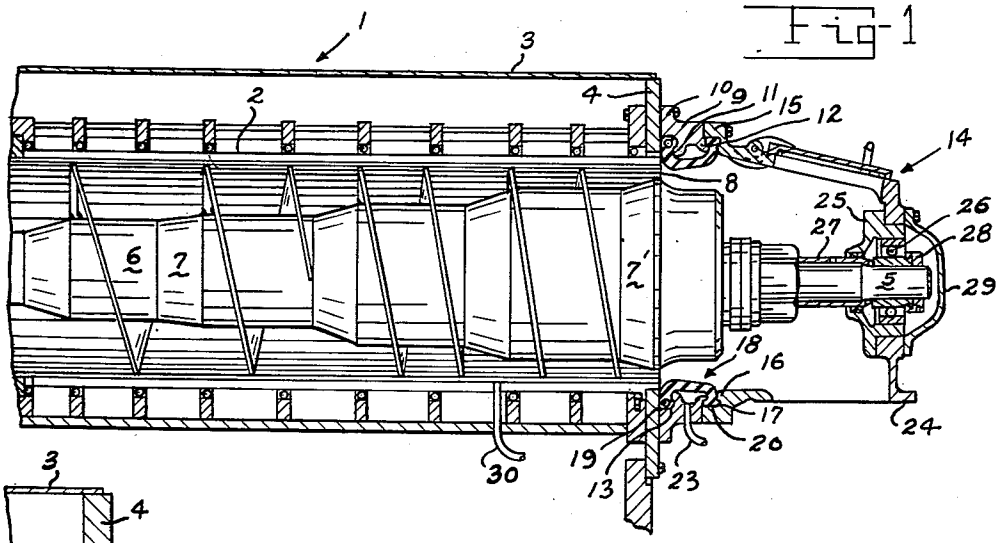
Nov. 20, 1962 M. E. GINAVEN 3,064,557

FLOW RESTRAINER

Filed July 15, 1959

Fig-1



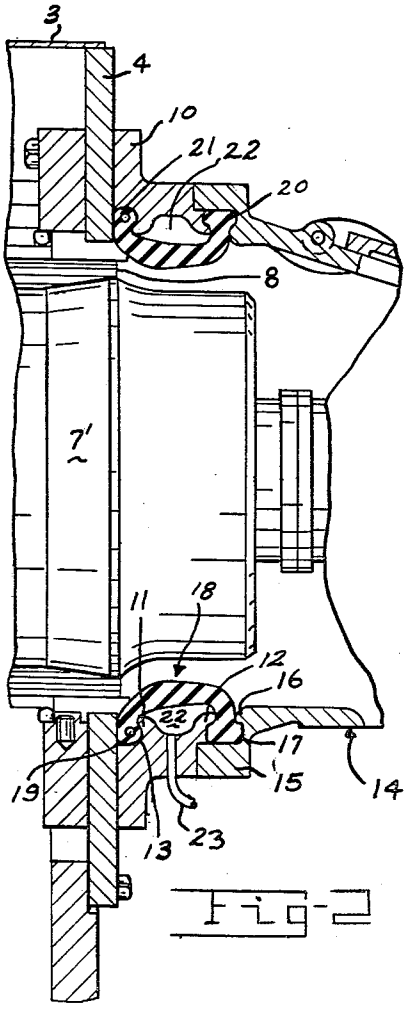
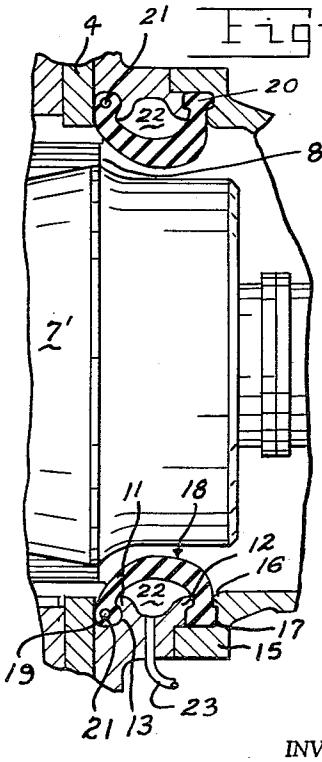


Fig-2

Fig-3



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FLOW RESTRAINER

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This invention relates to improvements in flow control apparatus for screw presses and the like.

The screw press is becoming a unit of considerable importance in pulp refining. Its efficiency is high and it holds promise of producing substantial economies in the art. However, its commercial application has been limited due to the difficulty of providing economical and adequate flow control therein.

Flow control is particularly important with reference to pulp refining. In pulp refining pulp stock is passed through a series of refiner units. In each unit the pulp is successively drained and fiberized to a particular degree depending on the nature of the material and the end product desired. To insure adequate draining and fiberizing of the pulp in each refiner unit it is necessary to incorporate means for introducing sufficient back pressure in the system to control the rate of stock flow and thereby the degree of work accomplished. There may be a wide variation in the consistency and body of the pulp stock. Therefore, unless the flow control means provided in the refiner is easily operated and capable of being sensitively adjusted, quality control is difficult and products are non-uniform. This necessitates additional work on the pulp, results in a need for additional equipment and consequently increases the cost of the products.

The screw press promises to be a particularly efficient pulp fiberizing device, if provided with an economical and sensitive means for flow control. As applied to pulp refining, it employs a perforate barrel. Its discharge orifice is annular, being defined by the barrel and the screw shaft extending therethrough. Efforts have been made to adapt the screw press to pulp refining applications by positioning a cylindrical or conical collar on the screw shaft outwardly of the press discharge orifice. The collar is generally arranged to slide on the shaft to and from the means defining the discharge orifice to vary its dimension and thereby produce a variable back pressure on stock introduced in the press. This type of flow control apparatus has proven to be quite costly, cumbersome and difficult to operate with any degree of precision or sensitivity.

A primary objective of the present invention is to provide improvements in flow control apparatus, particularly for units such as screw presses, whereby such units may be economically fabricated, more efficient and satisfactory in use, adaptable to a wide variety of applications and relatively trouble free. Its embodiment eliminates excessive cost and other limitations of conventional flow control apparatus previously utilized in pulp refining equipment.

Another object of the invention is to provide screw presses and the like with a highly sensitive flow control.

A further object of the invention is to provide screw presses and the like with simplified flow control apparatus which is very easy to operate.

An additional object of the invention is to provide a

simplified fluid operated flow control device in press apparatus.

Another object of the invention is to provide improved means for flow control in a screw press or the like including a resilient element which is capable of being distorted to apply a selective variable back pressure in the press.

A further object of the invention is to provide flow control apparatus possessing the advantageous structural features, the inherent meritorious characteristics and the means and mode of operation herein described.

With the above and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consist of the features of construction, the parts and combinations thereof, and the mode of operation as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawing wherein is shown one but obviously not necessarily the only form of embodiment of the invention,

FIG. 1 is a fragmentary sectional view of the discharge section of a screw press adapted for pulp refining incorporating improved flow control apparatus in accordance with the invention;

FIG. 2 is an enlarged view of the flow control apparatus illustrated in FIG. 1; and

FIG. 3 is similar to FIG. 2, but showing the flow control apparatus in distorted position.

Like parts are indicated by similar characters of reference throughout the several views.

FIG. 1 shows the discharge portion of a conventional press 1 including a perforate barrel 2. The barrel 2 is contained by a housing structure 3 which includes a centrally aperture end plate 4. The plate 4 immediately contains and is fixed about the discharge end of the barrel. The press has a main drive shaft 5 which extends through the barrel 2 and projects beyond the end plate 4.

The shaft 5 conventionally mounts conveying sleeves 6 and fiberizing and pressure sleeves 7 which are keyed thereto. The sleeves 6 have peripherally projected screw type blades while sleeves 7 are conical and arranged to expand to the discharge end of the barrel. The sleeves 6 and 7 are successively alternated and arranged to be of successively increased dimension to the discharge end of the barrel, the conical sleeves 7 forming bridges between the successively enlarged sleeves 6. Thus, the space between the sleeves 6 and 7 and the inner wall of barrel 2 is gradually reduced to provide successively greater squeezing and fiberizing of pulp as stock is moved through the press to the discharge end of the barrel. A sleeve 7' is provided on shaft 5 at the discharge end of the barrel 2 to define an annular discharge orifice 8 therewith.

A ring member 9 is provided with an external flange 10 to one end which seats to the outer face of plate 4 concentrically spaced from the discharge opening of barrel 2. The flange 10 is bolted to the plate 4 so the ring 9 projects coaxially with the barrel 2. The ring 9 has a pair of annular projections 11 and 12 on its inner surface which are relatively divergent in character.

The projection 11 is adjacent and angularly directed to the inner edge of plate 4 at its central aperture. Its projected extremity lies immediately about and slightly spaced

from the discharge end of barrel 2 to define an annular recess 13 with plate 4, the projection 11 forming a lip overlying the recess.

A generally conical shell 14 forms an axial projection of the ring 9 and converges therefrom. The expanded end of shell 14 has an external flange 15 seating to the outermost end of the ring 9. The portion of flange 15 to the inner surface of shell 14 lies opposite the projection 12 on ring 9 and is recessed to provide a lip 16 directed to and spaced from the extremity of the projection 12. In this way an annular recess 17 is provided between the abutting ends of ring 9 and shell 14.

A sleeve-like element 18, preferably of flexible plastic, overlies the inner surface of ring 9. The element 18 is provided with enlarged bead portions 19 and 20 at its lateral extremities respectively wedged in recesses 13 and 17. The bead portion 19 has a reinforced ring 21 of wire embodied therein and is contained in recess 13 by the angularly diverted projection 11 on ring 9. The head 20 is contained in recess 17 by the angular diversion of projection 12 and the lip 16 on the adjacent end of the flange 15. Thus, the angularity of projections 11 and 12 cause the sleeve-like element 18 to be held securely in place and to be thereby stretched across the projections to define an annular pocket 22 therebetween. A radial aperture 23 in ring 9 communicates with the pocket 22. A suitable fluid system (not shown) may be connected to ring 9 at the aperture 23 to provide means for introducing fluid to the pocket 22 under a selected pressure which is variable. By introducing fluid to pocket 22 under a predetermined pressure the central portion of the sleeve-like element 18 may be selectively distorted and projected inwardly to shaft 5 a predetermined amount. This enables a variable restriction of the discharge orifice 8 to produce a required back pressure in the barrel 2 on stock flowing therethrough.

As shown in the drawings, suitable washers and a lock nut are conventionally provided on the portion of shaft 5 projecting within shell 14 to lock the sleeve elements 6 and 7 against longitudinal displacement from their established positions. Also, a discharge outlet is provided in the bottom of shell 14 defined by a flange 24.

The outer end of shell 14 is centrally apertured to immediately confine a housing 25 for a bearing 26 receiving the projected end of shaft 5 therethrough. A spacer 27 about shaft 5 is positioned between the lock nut and the bearing 26 thereon while a retainer ring 28 on the outer end of the shaft contains the bearing to the spacer. A dust cap 29 is bolted over the outer end of shell 14 to cover and contain the bearing structure. It should be noted here that only so much of the conventional structure is described as is necessary for full disclosure of the present invention.

An understanding of the invention may be facilitated by a description of its use in a screw press, thereby adapted for versatile application to pulp refining.

To start proper operation of a screw press for pulp refining it is necessary that an initial back pressure be provided therein. As stock is introduced in the press, this promotes proper de-watering and the initiation of a proper degree of fiberization of the pulp. This back pressure is provided in accordance with the invention by operation of suitable controls in the fluid system in communication with pocket 22 to introduce fluid under a predetermined pressure in this pocket to cause a projection of the central portion of the element 18 inwardly to the shaft 5. Depending on the pressure of the fluid (pneumatic or hydraulic) which may be applied to the sleeve-like element 18, the discharge opening 8 from the barrel 2 may be selectively reduced to any degree necessary to meet the requirements of the situation. The greater the restriction the more work that is done on the pulp as it moves through the press. Once the proper pressure is established in the press barrel the fluid in pocket 22 may be evacuated totally or partially depending on the requirements of the process. In the event that drainage or fiberizing becomes inadequate during operation of the press, by simple adjustment of the fluid pressure in pocket 22 the sleeve element 18 can be flexed inwardly to shaft 5 to vary the back pressure on the stock a precisely required degree and maintain uniformity of product. Regardless of the consistency or body of the stock it may be seen that the same sensitive control can be simply and quickly provided by the embodiment of the invention. The fluid producing the back pressure in the press can obviously be metered quite precisely to get a quick and very fine adjustment of the element 18. The flow control medium is thus simple, easy to operate and highly sensitive. There is no complexity of structure to provide uncertainty of result.

The sleeve-like element may obviously be made condition responsive by conventional means to automatically adjust to maintain or vary the pressure on the stock in the press. For example, a pressure indicating device 30 may be connected in an intermediate portion of the barrel 2. By suitable instrumentation a variation from the required pressure in the barrel could cause a predetermined fluid pressure to be exerted on the element 18 to vary the outlet from the discharge orifice 8 and thereby produce a required stock flow to obtain the desired draining and fiberizing of pulp passing through the press.

Thus, the flow control apparatus of the invention is simple, compact, inexpensive, sensitive and readily operable from an adjacent or remote source.

The invention as described produces a particular economy and improvement in screw presses adapting them for versatile application in the pulping industry. However, it will be recognized by those versed in the art that the concepts of the invention are not so limited in application.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statutes the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A pulp refining equipment including a perforate cage defining a passage therethrough, an inlet at one end of said cage and an outlet at its opposite end, a shaft projecting through said cage and beyond said outlet, conveyor means on said shaft intermediate said inlet and outlet, a sleeve on the outer end of said shaft at the end of said cage having a first portion forming a restricted outlet with the outlet of the cage, said sleeve also having a second portion having a substantially annular concave surface at its outer end and being of a smaller diameter toward its outer end than said first portion, a resilient annular member semi-circular in transverse cross section having beads at its ends, said member being positioned around the sleeve at the end of the cage, said resilient annular member being secured to said cage by said bead portion, and means whereby the resilient member can be inflated to produce a variable restriction at the outlet between said cage and said shaft.

2. The structure according to claim 1, wherein the resilient member has a width substantially the same as the second portion of the sleeve carried by the screw.

3. The structure according to claim 1, wherein the resilient member is strengthened by a wire embedded within one of the beads.

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