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SCREW PRESS

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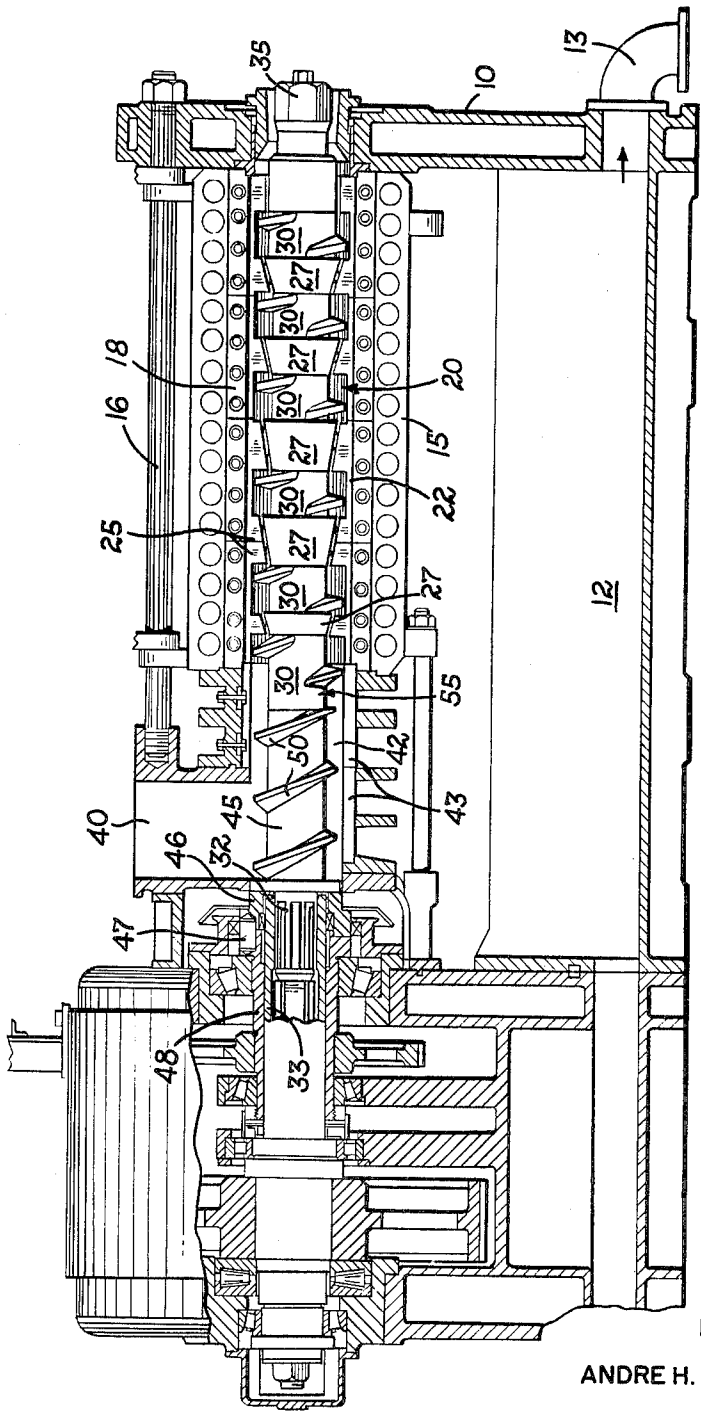

FIG-1

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SCREW PRESS

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This application is a continuation-in-part of copending application Serial No. 157,127, filed December 5, 1961, now abandoned.

This invention relates to screw presses, particularly high pressure expressing presses capable of continuous operation, and to a novel feeding arrangement for such presses which enables them to operate on material containing long stringy or string-like fibers.

In the screw presses which are used to express oils or other fluids from nuts, meals, etc., the press comprises a main body or cage with drainage openings through the side walls. The cage is of a relatively heavy or sturdy construction, capable of holding material therein under high pressures, for example in the neighborhood of one thousand to twenty thousand p.s.i. The material is fed through the press, and pressure is exerted upon it, by one or more pressure worms including screw flights which are mounted on and rotate with a drive shaft extending longitudinally through the cage, such screw flights having a rather close fit with the walls of the cage such that when they are rotated they press the material toward the discharge end of the cage. One or more breaker bars, or other suitable stationary or equivalent obstructing members are provided between the pressure worms to afford a restriction and a barrier to rotation of the flow of material, thus providing a means against which the material is pressed to obtain the desired high mechanical pressure. Under this pressure the fluids are expressed from the material and pass outwardly through the drainage openings, while the material solids are retained in the cage body.

The aforementioned pressing structure is usually fed by a feed worm which packs the material into the first of the pressure worms mounted within the cage. The feed worm receives the material from an inlet hopper, into which the material is dropped, or sometimes fed under a relatively low mechanical pressure, for example, a few pounds per square inch, and the feed worm takes up this material and carries it into the cage body. The worm may be rotated at a somewhat greater speed than the pressure worms, or its pitch may be different, so that the feed worm functions in the desired manner to compact the material initially and feed under some pressure into the first pressure worm.

When operating such a press upon materials of a fibrous nature, particularly materials having long stringlike or stringy fibers such as raw sugar cane fibers, sugar cane which has been torn or cut initially into suitable lengths, or cane bagasse (so called because it is bagasse obtained from the mills after a certain amount of juice is extracted from cane), these materials have been observed to clog at and around the area where the flight or flights of the feed worm pass from the hopper inlet into the entrance area of the main cage.

In this area, the stringy fibers fall or otherwise bridge over the edges of the flight of the feed screw, and collect in such fashion that they jam against the cage body, in other words between the peripheral edge of the flight on the feed screw and the interior surface of the cage. These collecting fibers produce such a high load upon the shaft, resisting turning thereof, that they cause erratic operation of the press, with the result that they initially produce a high turning load, with relatively low throughput capacity, until such time as the fibers are cut, sheared, or torn in this area, whereupon the load upon the feed screw

is suddenly reduced considerably. Thus, the load upon the drive motor of the press is fluctuating under such operating conditions and has been observed, for example, to change over a range of 100 amperes to 300 amperes, using a 200 horsepower motor with an impressed electrical potential of about 440 volts.

In accordance with the invention the collecting, bridging, and jamming of the fibers around the feed screw flight, and between such flight and the cage walls, is avoided by providing a substantial spacing between the peripheral edge of the feed screw flight and the surrounding cage wall. For example, it has been customary practice in the past, in presses constructed as described above, to afford a clearance between the feed screw flight and the cage wall of approximately one thirty-second of an inch. This clearance is, when operating with the stringy fibrous materials, not sufficient to prevent the jamming and erratic operating conditions mentioned as producing the fluctuating load upon the press. It has been found, however, that although it would not be expected, an increase in this clearance will obviate the jamming and load fluctuation conditions while still maintaining an effective feed of the material. Such an arrangement is unknown in the art, and contrary to prior teachings according to which it would be expected that an increase in feed worm clearance would in turn result in an ineffective feeding operation, with much of the material passing back around the feed worm and failing to carry forward into the first pressure worm. It has been discovered that with an increase in feed worm clearance to provide a spacing in the order of one-half of an inch or more (satisfactory results having been obtained with upwards of seven-eighths of an inch clearance) an effective continuous feed of this fibrous material is maintained, and the load on the press drive is even, instead of fluctuating.

Accordingly, the primary object of this invention is to provide a novel feeding arrangement for high pressure screw presses, permitting effective continuous feed of stringy fibrous material into the press.

Another object of the invention is to provide a high pressure continuous press feed arrangement in which the feed worm initially carrying material into the press extends into the barrel of the press and has an unusually large clearance with respect to the walls of the press barrel, and in which such feed worm functions to force fibrous material into the first pressure worm of the press which has normal minimal clearance.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

In the drawing, FIG. 1 is a vertical sectional view, with some parts in elevation, taken along the vertical center line of an interrupted flight high pressure screw press constructed in accordance with the invention.

Referring to the drawing, the press structure includes a main frame **10** including a collection pan **12** which receives expressed liquids, which may be discharged through the elbow **13**. The main cage or barrel of the press is formed by an outer cage section **15** which is mounted to swing from the rod **16**. There are two such sections, normally bolted together, however the drawing shows the cage opened, i.e., with the sections separated, and the nearer section removed. Details of a suitable cage construction are well known in the art, and may be found, for example in United States Patent Nos. 2,421,763; and 2,320,765, both assigned to the same assignee as this application. Inside each of the outer cage sections there are inner sections **18** mounting spaced screen bars shown generally at **20**, and these screen bars are held in place by center bars **22** bolted to the inner cage sections. At least some of the center bars also include breaker lugs **25** when project readily into the cage.

These lugs cooperate with collars 27, which may or may not be tapered, as desired, to form between them zones wherein the material is caused to move axially of the cage, and the material is packed into and forced through these zones by the preceding pressure worms 30. The worms and the collars are mounted upon a drive shaft 32, the end of which is shown extending into its splined drive sleeve 33. The collars and worms are held on the shaft by the end nut 35, and the worms have the normal minimal clearance with the cage walls, in the order of one thirty-second of an inch.

The inlet to the cage is formed by a vertical hopper or feed opening 40, which opens into the inlet chamber or section 42 of the cage. Suitable screen bars 43 may also be mounted to form portions of the walls of the chamber providing for passage of liquids expressed in this initial section of the press.

A feed worm 45 is mounted on the main shaft 32, extending through the feed hopper and the entrance area of the press, and abutting the first pressure worm 30. Preferably, the feed worm is rotatable independently of the shaft, and it is driven by a collar 46 which engages through one or more drive pins 47 with the quill or sleeve 48. Such a construction provides for a faster rotation of the feed worm 45 in those constructions where such an arrangement is desired.

Feed worm 45 is provided with one or more conveying flights 50. These flights are preferably continuous from one end to the other of the feed worm body. Depending upon whether it is advantageous to drive the feed worm at a faster rate than the pressure worms, or at the same rate, the pitch of the feed worm may be substantially different from the pressure worm pitch. For example, it is possible to obtain the desired packing or feeding action from the feed worm in some cases by driving it directly from the shaft 32 while increasing the pitch of the feed worm flight. The advantages and disadvantages of these feed worm constructions are known to those skilled in the art.

In accordance with this invention, however, the clearance between the periphery of the feed worm flight 50 and the inner walls of the cage inlet section 42 is significantly greater than the clearance normally employed. For example, normal running clearance in prior art presses is approximately one thirty-second of an inch. Attempts have been made to relieve the erratic operation previously mentioned by increasing the running clearance of the feed worm flight by approximately double the normal minimal clearance, in other words by an increase to approximately one-eighth inch clearance. It has been discovered, however, that even this much increase in clearance was not effective in alleviating the condition, and therefore in accordance with the invention the clearance between the flight 50 and the inlet section walls is in the order of approximately one-half of an inch, and satisfactory results have been obtained with a clearance up to approximately seven-eighths of an inch. This clearance is considered to be substantial in this art, since it is clear from the foregoing exemplary dimensions that even a clearance of one-half of an inch is about sixteen times the usual running clearance. It may be mentioned also, that in suitable arrangements of the invention the height of the feed worm flight 50, in other words its extent radially from the worm body 45, is about two inches.

This clearance is maintained throughout the length of the feed worm, such that stringy fibers or similar material can bridge or hang over the periphery of the feed worm flight and still be fed forward and packed into the first pressure worm 30 without producing any substantial drag against the walls of the inlet section, and particularly without collecting and jamming between the flight 50 and the inlet section walls. The transition from the greater clearance at the feed worm to the minimal clearance at the first pressure worm should be abrupt, rather than gradual as with a tapered worm, and it is preferred, although not necessary to leave an axial gap, as shown at 55, between these worms.

Furthermore, the feed worm extends substantially into the inlet section 42 of the press. In other words, the feed worm passes across the bottom of the hopper or feed opening 40, and into the inlet chamber or section 42 of the cage having substantial distance, as will be apparent from inspection of FIG. 1. For example, in the embodiment shown the feed worm flight wraps about the body approximately two and one-half turns. Of this extent of the feed worm, approximately one-half is beneath the inlet opening 40 and the other half extends into the cage inlet 42, so that the feed worm functions to carry the stringy material well into the cage. It should be understood that this example is merely illustrative of the invention, and that it is not required to have the feed worm extend for at least half its length into the cage inlet, however, there should be more than a slight extension of the feed worm into the cage inlet, in other words the length of the feed worm should be substantially greater than the opening in the bottom of the feed hopper 40. The arrangement can vary with the use of different pitch of the feed worm, as might be desired for example if a feed worm is utilized at the same rotational speed as the main shaft, since in that case the pitch of the feed worm would preferably be changed to produce the desirable higher carrying rate of the feed worm to force the material into the main cage.

Accordingly, with a construction as described above it is possible to handle, and to feed effectively, the materials having string-like fibers of substantial length such as mentioned previously, while maintaining a substantially constant load upon the press and while maintaining a continuous effective conveying of the material through the press.

While the form of 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 therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a continuous screw press adapted to work on fibrous material having fibers of substantially long and string-like character, the combination of a cylindrical main press cage having drainage openings in its walls for passage of fluids expressed from the material, means including pressure worms in said cage extending into closely spaced relation with the walls of said cage for exerting high mechanical pressures on the material, means for rotating said worms during operation of said press in a manner to convey the fibrous material through said cage while exerting pressure thereon, an inlet to said cage including a feed hopper and a cylindrical inlet section extending from the bottom of said feed hopper and substantially beyond the lower end of said hopper into said cage and aligned with said cage for conveying material to the first of said pressure worms, a rotatable feed worm extending across the bottom of said feed hopper and substantially into said inlet section, a drive for turning said feed worm to take up material from said hopper and carry such material through said inlet section to force such material into said cage, said feed worm having a conveying flight with an outer diameter substantially less than the inner diameter of said inlet section forming a relatively wide space in the order of at least one-half inch between the edge of said flight and the wall of said inlet section, said relatively wide space being substantially larger than the space between said pressure worms and said cage to provide for bridging of long fibers of the material over said flight while maintaining a continuous movement of the fibrous material from said hopper into said main cage.

2. In a continuous screw press adapted to work on fibrous material having fibers of substantially long and

string-like character, the combination of a cylindrical main press cage having drainage openings in its walls for passage of fluids expressed from the material, means including pressure worms in said cage and having a close running clearance therewith in the order of one thirty-second of an inch for exerting high mechanical pressures on the material, means for rotating said worms during operation of said press in a manner to convey the fibrous material through said cage and to exert pressure thereon, an inlet to said cage including a feed hopper and a cylindrical inlet section extending from said feed hopper substantially into said cage and aligned with said cage for conveying material to the first of said pressure worms, a rotatable feed worm extending across said feed hopper and substantially into said inlet section and having a drive arranged to turn said feed worm to take up material from said hopper and force such material into said cage, said feed worm having a conveying flight with a constant outer diameter substantially less than the inner diameter of said inlet section forming a relatively wide space between the edge of said flight and the wall of said inlet section through which space long fibers of the material can extend over the periphery of said flight to maintain a continuous movement of the fibrous material from said hopper into said main cage and to avoid collection of said long fibers between said feed worm flight and the walls of said inlet section, said wide space between the wall of said inlet section and the edge of said feed worm flight being in the order of sixteen to twenty-eight times greater in width than the close running clearance between said pressure worms and the walls of said cage.

3. A continuous screw press as defined in claim 1, wherein said relatively wide space between the edge of said conveying flight on said feed worm and the wall of said inlet section is in the range of approximately one-half inch minimum width and approximately seven-eighths inch maximum width.

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