

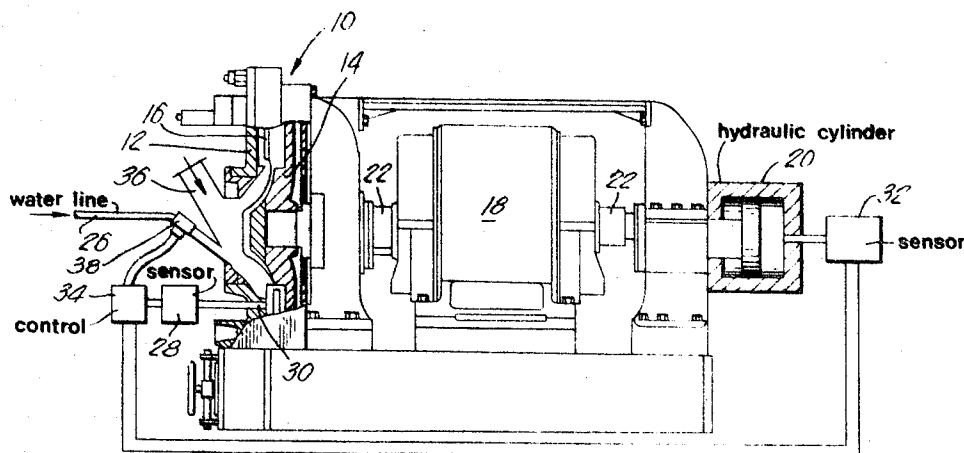
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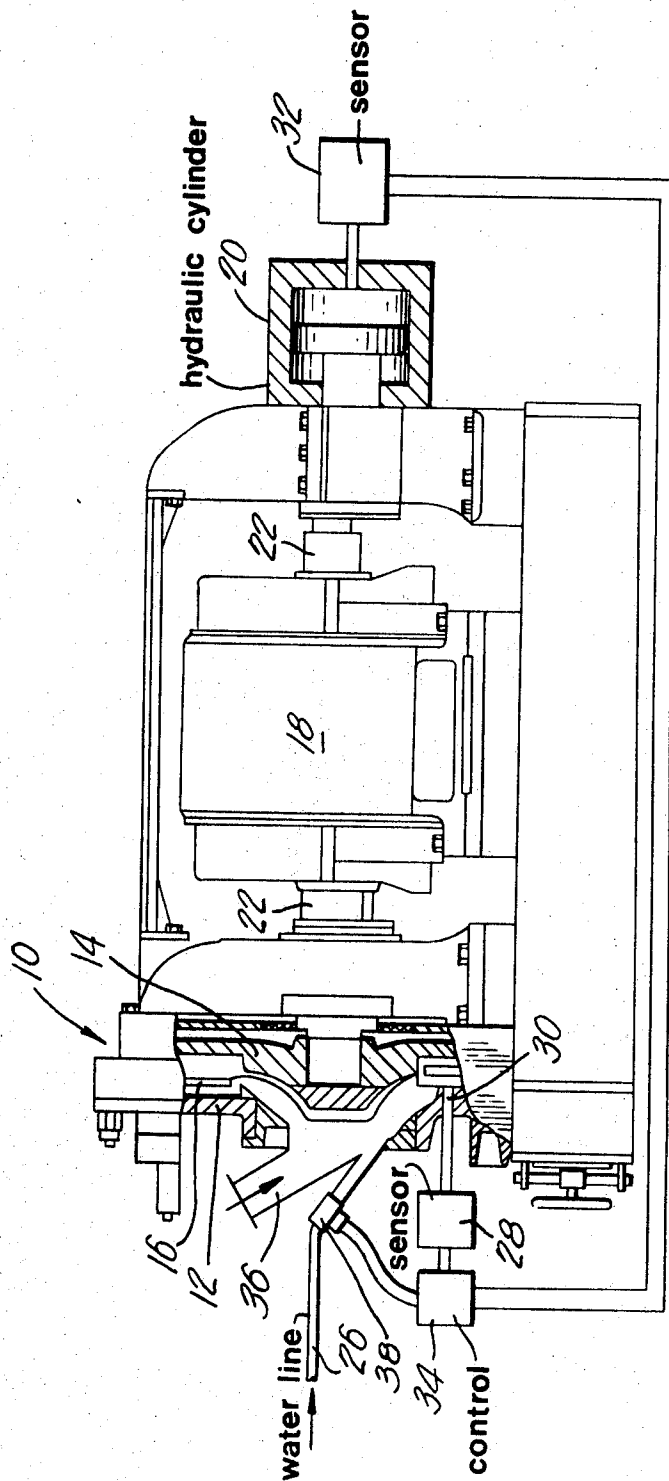
[56] **References Cited**
UNITED STATES PATENTS
 2,156,320 5/1939 Sutherland, Jr. 241/28
 2,561,043 7/1951 Ayers 241/28 X
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[54] **REFINER CONTROL**
9 Claims, 1 Drawing Fig.

[52] U.S. Cl. **241/21,**
241/28, 241/34
 [51] Int. Cl. **B02c 7/00**
 [50] Field of Search **241/21, 28,**
33, 34, 38, 62, 65, 245

ABSTRACT: A refining system wherein the consistency of the raw material fed and the energy applied to a refining zone defined by a pair of relatively rotating discs are regulated to ensure that steam generated between the discs develops a counterthrust tending to balance the pressure applied to the refining zone and wherein the steam pressure in the zone is sensed and the dilution water added controlled in accordance with this pressure sensed, thereby to maintain a balancing counterthrust between the discs, whereby effective disc separation may be maintained together with substantially uniform stock quality while avoiding plate clashing.





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REFINER CONTROL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a refiner control. More specifically, the invention relates to a refiner control for high-energy high-consistency operations.

2. Description of Prior Art

One of the major expenses in the operation of refiners is the wear and replacement costs on refiner plates. During refining, it has been found that even when care is taken to ensure a uniform rate of feed of raw material to the refiner and particularly with large refiners operating at high working pressures, occasional disc clashing occurs. This disc clashing results in a high wear factor for the disc, thereby increasing the cost of operation of the equipment. It is believed that this clashing between the discs may be caused by a relatively small change in pressure between the discs relative to the working pressure applied to the movable discs.

Many attempts have heretofore been made to control the relative positions of the disc by servo adjustment of the hydraulic mechanism applying the working pressure to the disc. Examples of such devices are shown, e.g. in U.S. Pat. Nos. 2,642,781 issued June 23, 1953 to Croake et al. 2,947,485 issued Aug. 2, 1960 to Woodruff et al. 2,971,704 issued Feb. 14, 1961 to Johansson, and 3,212,721 issued Oct. 19, 1965 to Asplund et al. While the controls disclosed in these patents may be adequate for the purpose intended, they are generally not successful in application to larger refiners operating at high loadings to control the positions of the discs and prevent clashing thereof.

SUMMARY OF INVENTION

The present invention is primarily based on the discovery that during refining of chips or pulp under high-consistency conditions and high loading, steam is generated between the discs and that this generated steam develops a counterthrust or back pressure between the discs tending to resist the working pressure applied to the refiner and that this generated steam pressure may be varied by changing the amount of water introduced with the raw material, i.e., adjusting the consistency of the material introduced.

Broadly, the present invention relates to an apparatus and method wherein the relative location of a pair of opposed refiner discs is sensed and the amount of water introduced between the discs is adjusted accordingly, preferably by sensing the working pressure applied to the discs, sensing the back pressure generated between the discs, comparing the two pressures and controlling the amount of dilution water added at the inlet to the refiner.

BRIEF DESCRIPTION OF DRAWINGS

Further features, objects and advantages will be evident from the following detailed description of a preferred embodiment of the present invention taken in conjunction with the accompanying drawing:

The drawing is a partial section schematically illustrating one form of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

As shown, the refiner 10 may be any conventional type of refiner having at least a pair of relatively rotating discs. In the illustrated arrangement, there is a fixed disc 12 which is formed by part of the refiner housing and a rotatable disc 14 each of which carries conventional refining plates 16. The rotating disc 14 is driven in the illustrated arrangement by means of a motor 18 and the working pressure is applied to the disc 14 by means of a hydraulic system 20 that operates in a conventional manner on the shaft 22 which may be splined to

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the armature of the electric motor 18 to permit relative movement, to adjust the position and pressure applied to the refiner disc 11. Any other system of controllably locating the disc 14 relative to disc 12 or vice versa, applying pressure to the refiner and driving the refiner may be used.

Raw material to be treated is introduced to the refiner by the inlet schematically illustrated at 36. Obviously, with high-consistency stock, normally a screw-type conveyor or other suitable conveying means will be used to introduce the material into the refiner. Additional diluting water is also introduced, preferably via waterline 26 which is connected to suitable nozzle means or the like located closely adjacent the working area of the refiner.

The present invention provides a sensor 28 to sense the pressure between the discs 12 and 14. This sensor 28 is coupled to a sensing element 30 which has been schematically illustrated in the drawing and is adapted to directly sense the pressure between the two discs 12 and 14. One form of sensing element 30 that is contemplated is a small pipe leading air into the refining zone to sense the pressure in the same manner as a bubble tube in a liquid level-sensing instrument.

At the same time as the pressure between the discs 12 and 14 is being sensed, the pressure applied to the rotatable and movable disc 14 is also sensed. For example, by means of a sensor schematically illustrated at 32 connected to the hydraulic system 20. The pressure between the discs as sensed by the sensor 28 and that applied to the disc 14 as sensed by the sensor 32 are compared by a comparator and control system schematically illustrated at 34. This control mechanism is operative to adjust toe valve 38 in the water line 26 and thereby control the amount of dilution water supplied to the refiner. This control need not be applied to the total dilution water added to the refiner, but may simply be used to control an auxiliary line which adds a portion of the dilution water required.

If the pressure on the disc 14, i.e., in the hydraulic system 20 is constant there would be no need for sensing and comparing the pressure with the pressure between the discs, but instead the sensor 28 could directly control the valve 38.

The control is operated in the following manner. When the pressure applied to the discs as sensed by the sensor 32 is not properly balanced with the pressure as sensed by the sensing means 28 the controller 34 will either reduce or increase the amount of dilution water introduced. When the pressure sensed by sensing means 28 is too low the controller 34 reduces the amount of dilution water introduced, thereby increasing the amount of steam that will be formed and increasing the back pressure between the discs, thereby tending to rebalance the working pressure applied by the hydraulic system 20 to the disc 14 with the pressure generated between the discs and thus maintain the desired clearance. On the other hand, if the pressure sensed by sensing means 28 is too high relative to the pressure sensed by sensor 32, the amount of dilution water is increased to decrease the back pressure generated between the discs and again balance the system.

The control of the present invention may only be operative under certain operating conditions. It is necessary, if the present invention is to be used, that the refining conditions be such that steam is generated between the discs in sufficient quantities to develop a significant counterthrust. Generally this will require that the consistency of the raw material be relatively high, e.g. with chips it is doubtful that the system could be operated much below about 8 percent consistency and preferably the operation will be above about 20 percent and will not exceed about 30 percent. With pulp, the consistency should not be much less than about 10 percent. Again, the consistency changes will not operate under all conditions, it being necessary to have a relatively high energy dissipation between the discs before steam in the required quantities will be generated.

The following table of calculated amounts of steam that would be generated between plates under different operating conditions provides an indication of operating conditions under which the present invention may be applied.

TABLE I

Motor HP	Plate area, in. ²		Energy intensity, HP/in. ²		Con- sistency between plates	Steam, lb./sec.	Area, lb. steam/ in. ² /lb./sec.	
	Chip	Pulp	Chip	Pulp			Chip	Pulp
4,000-----	572	883	7.0	4.5	24	2.1	272	420
					17	1.8	318	491
					11	1.6	358	552
					9	1.4	409	631
					7	0.9	636	981
2,000-----	718	718	2.8	2.8	26	1.1	653	
					20	1.0	718	
					17	0.9	798	
1,000-----	487	487	2.1	2.1	24	0.6	811	
					17	0.5	974	

It is evident from the above table that with different energy applications for both chips and pulp, the consistency may be varied considerably and the present invention still applied. It is doubtful, however, with a low-energy application as above-indicated at 2.8 hp./in.² even with a consistency of 26 percent, that the present invention would be operable due to the large area required to produce a pound of steam, i.e., due to the small amount of steam generated between the discs. It is believed that the energy application should, in all cases, exceed about 3.5 hp./in.² and preferably be in the range of 4 to 10 hp./in.². Even at 9 percent consistency and an energy input of 4.5 hp./in.² for pulp, it is borderline for operability as is the 7 percent consistency and 7 hp./in.² operation on chips.

In considering the above table, it must be noted that the values given are calculated and are not actual measured values and, therefore, in practice the ranges may vary.

In the above description, one form of sensing element 30 has been described. The location of the sensing element 30 radially with respect to the plates will change the value of the pressure sensed. This change in value will be appreciable and, therefore, the sensor 28 and comparing and control means 34 must be calibrated accordingly.

As described above, the control is operated by directly sensing the pressure between the discs 12 and 14, however, other suitable means for sensing the pressure between the discs may be used. For example, the relative positions of the discs 12 and 14 may be directly sensed and used to control (the position of the discs will in part determine the counterthrust between the two discs). Also, if suitable means are available, the temperature on the working surface of the disc may also be used as a control. However, generally temperature-sensing devices do not have a sufficiently rapid response and, therefore, care would have to be taken in selecting such a controller.

It has also been found that the fiber length of the material produced by the refining operation is dependent on the consistency of the material introduced. This is particularly true under high-loading conditions as outlined hereinabove. For this reason, it is preferred to operate particularly when chips are processed at consistencies above those heretofore considered practical. Preferably, the operating consistency will be above about 23 percent, say somewhere between 23 and 27 percent. Also, in view of the fact that it has been discovered that fiber length changes with consistency and consistency varies the back pressure or counterthrust between the discs, if suitable equipment for continuously and quickly sensing the fiber length where available control of the dilution water could be effected by sensing the fiber length of the material produced.

With the fiber length-sensing equipment presently available, the fiber length sensed can only be used to adjust the basic

operating conditions, i.e., to select the consistency of operation to obtain the desired fiber length with the pressure sensor 28 operating to make the instantaneous adjustments necessary to control the position of the movable disc 14.

Modifications may be made without departing from the spirit of the invention as defined in the appended claims.

I claim:

1. A method of refining comprising feeding raw material into a refining zone, applying energy to said refining zone under a working pressure, coordinating the consistency of said raw material with said energy to generate steam in said zone and to provide a counterthrust sufficient to balance said working pressure, controlling the consistency of said raw material in said zone by controlling the amount of dilution water added to said zone, thereby to maintain said balance between said counterthrust and said working pressure.

2. A method as defined in claim 1, wherein said amount of dilution water is controlled by sensing the pressure in said zone and controlling the amount of dilution water in accordance with the pressure sensed.

3. A method as defined in claim 2, further comprising comparing the pressure in said zone with said working pressure and controlling the amount of water added in accordance with the ratio of said working pressure to said pressure in said zone.

4. A method as defined in claim 3, wherein said consistency is in the range of 8 to 30 percent.

5. A method as defined in claim 3, wherein said energy is applied in the amount of at least 4 hp./in.².

6. A method as defined in claim 3, wherein said consistency is in the range of 8 to 30 percent and wherein said energy is applied in the amount of at least 4 hp./in.².

7. A refining apparatus comprising a pair of relatively rotatable refining discs, means for introducing fibers of raw material between said discs, means for applying a working pressure to at least one of said discs, means for rotating one of said discs, sensing means for sensing the pressure between said discs, means for introducing dilution water between said discs, control means for controlling the amount of dilution water added, said sensing means operating said control means to regulate the amount of dilution water added in accordance with the pressure sensed.

8. An apparatus as defined in claim 7, wherein said pressure between said discs is sensed by a sensing element sensing said pressure directly.

9. An apparatus as defined in claim 7, further comprising means for sensing said working pressure, means for comparing said working pressure with said pressure between said discs and operating said control means to adjust said amount of dilution water added.

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