Dec. 17, 1968 D. G. LOBLEY 3,416,668

TABLE FILTER WASHER

Original Filed June 22, 1964 3 Sheets-Sheet 1

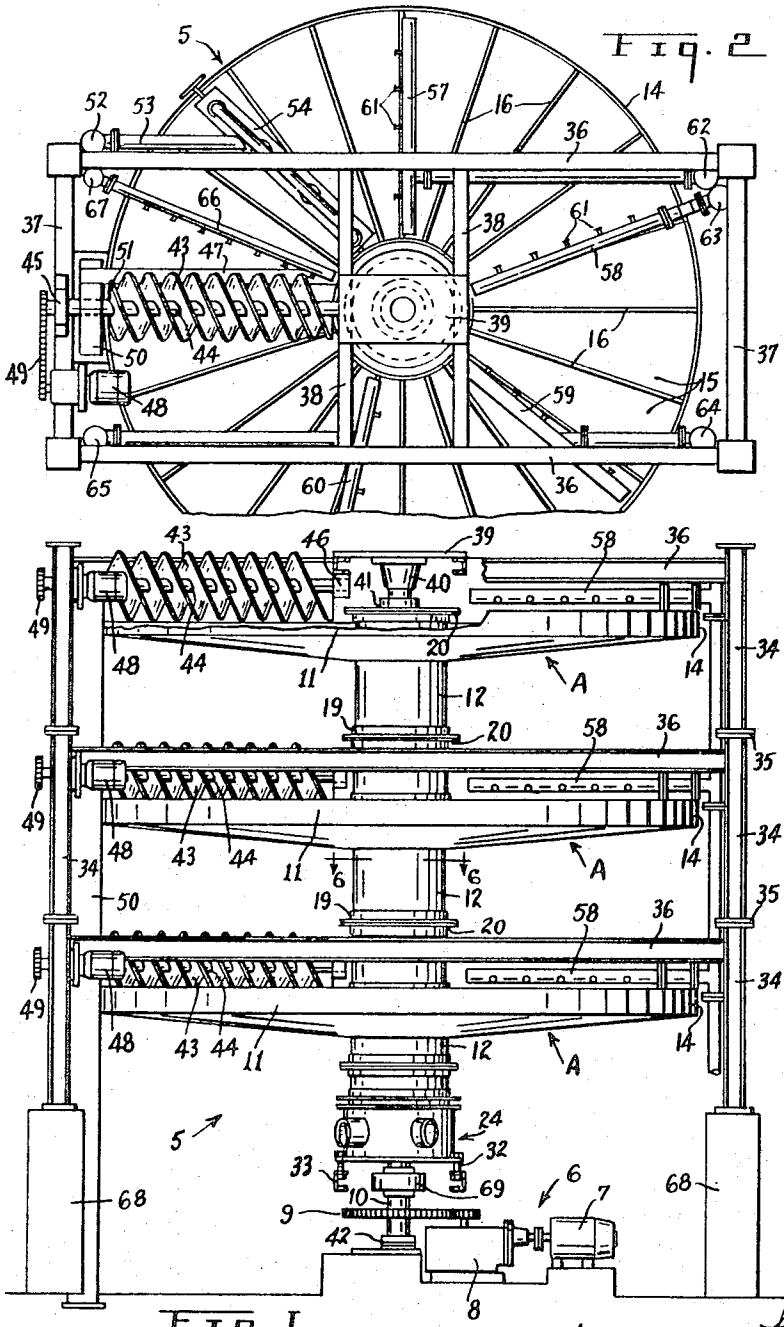


Fig. 1

Fig. 2

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TABLE FILTER WASHER

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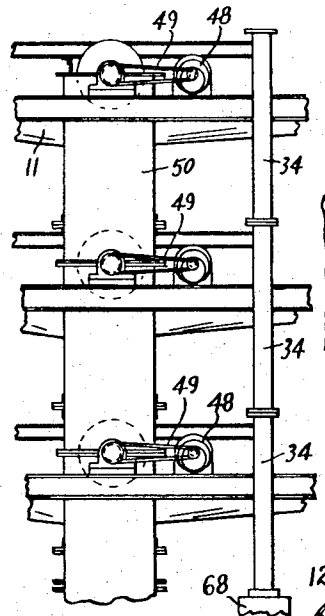


Fig. 3

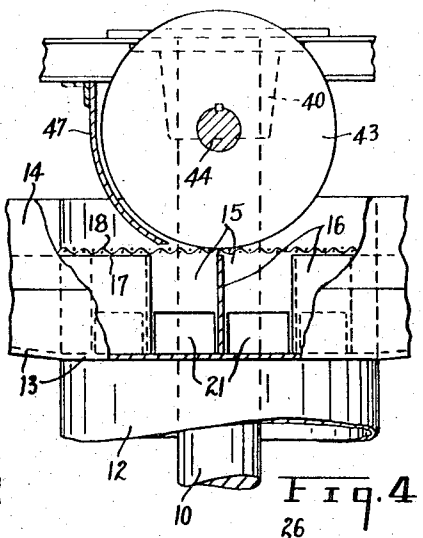


Fig. 4

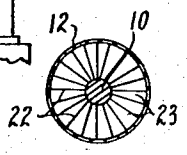


Fig. 6

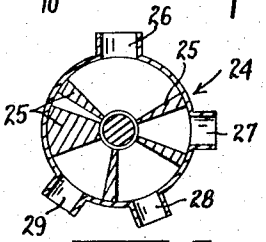


Fig. 7

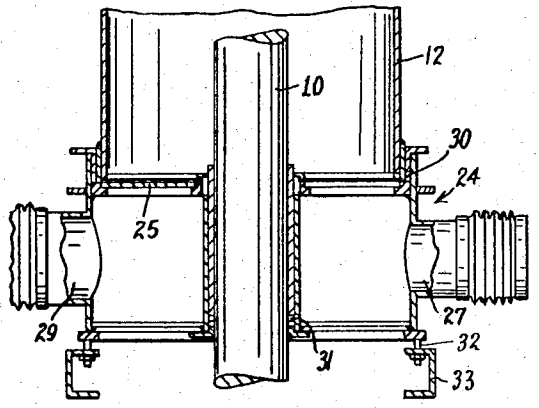


Fig. 5

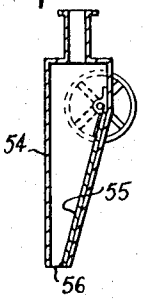


Fig. 8

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TABLE FILTER WASHER

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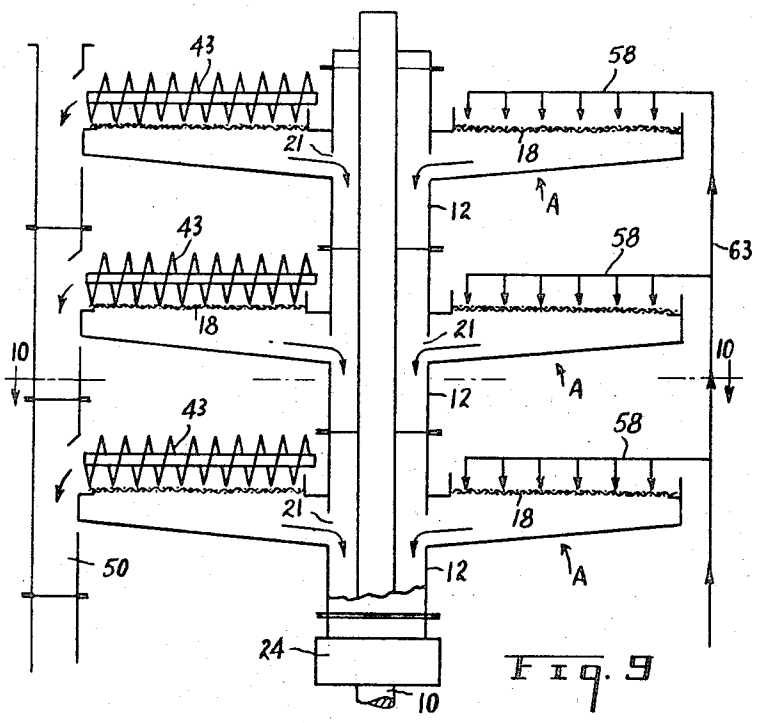


Fig. 9

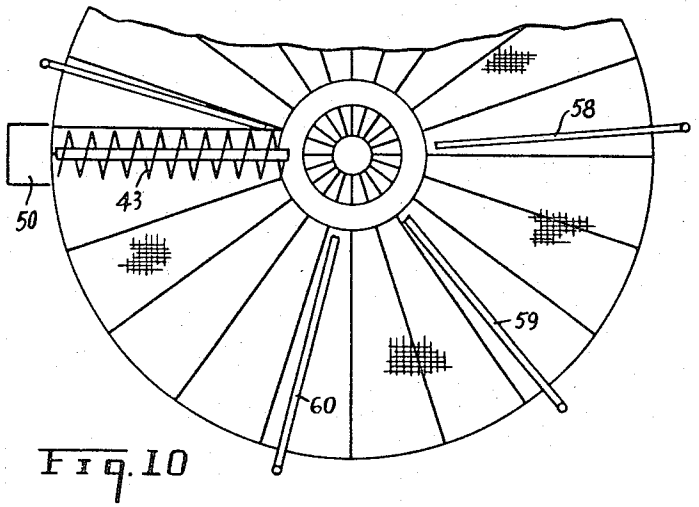


Fig. 10

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TABLE FILTER WASHER

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Continuation of application Ser. No. 377,006, June 22, 1964. This application Aug. 23, 1967, Ser. No. 662,835
3 Claims. (Cl. 210—203)

ABSTRACT OF THE DISCLOSURE

A rotatable table-type pulp thickener unit vertically stacked and readily extended to increase total capacity.

This application is a continuation of application Ser. No. 377,006, filed June 22, 1964, and now abandoned.

This invention relates to a machine for the counter-current washing and filtration of fibrous, granular and crystalline products and particularly for use in the washing and thickening of pulp stock.

Its greatest application will be in the counter-current washing of soda, sulphate and N.S.S.C. stocks in kraft and sulphite pulp mills. With sulphate cooked fibre being the predominant product in kraft mills today, the invention will be described in connection with the manufacture of such fibre.

The present method of washing cooking liquor and dissolved solids from sulphate stock is by a counter-current washing system, employing two or more filter-washers depending on the number of washing stages required. The stock is fed into one end of the system and proceeds for purposes of this description from left to right in the process. Fresh wash water is applied at the end of the system, and by a series of pumping cycles, is applied to the pulp in a direction opposite to the direction of movement of stock. In this type of operation, is is necessary to dilute between stages, in order that the filter-washer can pick-up an acceptable sheet for the next stage of washing. The operation can, therefore, be described as continuous, using dilution and displacement washing techniques to remove black liquor and dissolved solids from the pulp.

The effectiveness of the whole cycle is dependent on a number of factors, but the prior aim of the operation is to remove the maximum amount of dissolved solids and liquor with the minimum amount of wash water. By thus so doing, the minimum amount of water will require to be evaporated prior to the Recovery Furnace, and an obvious power economy will ensue.

A large factor in the overall cost of such a system (commonly called "Brownstock Washing") is the space requirement, and the relative inflexibility of operation with stock tonnage fluctuations. For instance, if a system was installed to handle a capacity of 200 tons per day, and the mill required to expaand its facilities to 400 tons per day, duplicate washers would have to be puchased and equivalent floor area provided at much expense.

This invention describes a method in which basically the same machine is used for such a situation, and in which any expansion up to 500 tons per day can be handled without increase in floor space or mechanical drive facilities.

The invention comprises one or more tables of filters rotating with a center shaft and driven from a central power source at the base of the shaft. Each table with its own center shaft section, supporting structure, scroll discharger and discharge chute, are of the same design and construction, thus enabling any multiplicity of five tables to be simply bolted on the bottom table section. For this machine, a total of six tables maximum will be

deemed practical and commensurate with the torque-horsepower output of the main drive.

Each table will be fed and discharged independently, and countercurrent washing of pulp up to four stages will be carried out on each table. All washing will be by displacement, none by dilution and the strong liquor and filtrate stages will be separated by an automatic positive clearance type valve at the base of the center shaft.

The object of the invention is to provide a table type pulp thickener unit capable of being stacked one above the other to any desired height and capacity.

A further object of the invention is to provide a common axial drive shaft by means of which the stacked tables are rotated as a unit.

A further object of the invention is to provide means to remove the thickened pulp from each table in the stack and discharge it into a common discharge chute.

A further object of the invention is to provide individual drives for the pulp discharge means at each of the stacked tables.

A further object of the invention is to provide a pulp thickener machine which will take up a minimum of floor space and where capacity can be added to with a minimum of conversion.

These and other objects of the invention will be apparent from the following detailed specification and accompanying drawings, in which:

FIG. 1 is a front elevation of a typical installation of stacked table pulp thickeners according to the present invention.

FIG. 2 is a partial plan view of the installation shown in FIG. 1.

FIG. 3 is a partial side elevation of the installation shown in FIG. 1 showing the individual drives for the scroll pulp discharge mechanisms.

FIG. 4 is an enlarged partial elevation of the top table thickener partly in section to show the discharge scroll, the screen and the water discharge openings.

FIG. 5 is an enlarged vertical section of a typical water discharge valve at the base of the water discharge column.

FIG. 6 is a horizontal cross section through the center column taken on the line **6—6** of FIG. 1.

FIG. 7 is a horizontal cross section of a typical valve bridge setting.

FIG. 8 is a vertical section through the head box showing the variable slice.

FIG. 9 is a diagrammatic vertical section showing the table elements of FIG. 1 and the method of wash water drainage and dried pulp discharge.

FIG. 10 is a partial plan view taken on the line **10—10** of FIG. 9.

Referring to the drawings which illustrate the invention particularly adapted for the filtration and thickening of pulp stock, the machine **5** is formed from two or more table type units A stacked one above the other and rotated by a common drive **6** comprising a motor **7**, a reduction gear unit **8** and gearing **9** drivably connecting the reduction gear unit to the drive shaft **10**.

Each table unit A comprises its own section of shaft **10**, a circular table member **11**, mounted about a central hollow column member **12**, and consisting of a dished bottom plate **13** (see FIGURE 4) angled upwardly and outwardly from the column member **12** towards an outer vertically disposed peripheral wall **14**. The interior of each table member **11** is divided into sectors **15** by vertically disposed radial walls **16** (see FIGURES 2 and 4). These walls **16** project upwardly from the inner surface of the dished bottom plate **13** to a level slightly above the level of the juncture of the bottom plate **13** with the peripheral wall **14** to support on their upper horizontal edges **17**, a screen **18** (see FIGURES 4 and 9).

Each of the hollow column members **12** has a lower flange **19** (see FIGURE 1) and an upper flange **20** by means of which the individual column members are axially joined to form a continuous water drainage path. The water collected in each of the table sectors **15** is permitted to drain into the hollow column members **12** through apertures **21** formed in the latter (see FIGURE 9).

The drive from each shaft **10** to its associated table member **11** is effected by radial webs **22** connecting the shaft **10** to the inner periphery of the coaxial column member **12**. These webs **22** are radially aligned with the radial walls **16** of each table **11** and serve to form individual drainage passages **23** (see FIGURE 6) within the columns **12** for a purpose which will be explained later.

The lower end of the axially aligned and joined column members **12** is provided with a positive clearance valve **24** (see FIGURES 1, 5 and 7) provided with adjustable bridges **25** (shown in FIGURE 7) completely to separate the filtrates and thus prevent contamination between stages. As will be seen more clearly from FIGURE 7, the bridges **25** isolate valve outlets **26**, **27**, **28** and **29** from each other. A stuffing box **30** (see FIGURE 5) is located between the valve **24** and the lower end of the lowermost column member **12** and a second stuffing box **31** is radially located between the valve and the drive shaft **10**. The valve **24** is located in position by means of jack screws **32** mounted on a support structure **33**.

Each table unit A includes a framework support comprising four vertical corner members **34** (see FIGURES 1 and 3) having end flanges **35** by means of which the framework associated with each table unit can be joined together vertically one above the other, and horizontal members **36** and **37** (see FIGURES 1 and 2), secured at their ends to the vertical members **34**, form a rectangular structure about each table unit.

A pair of parallel cross members **38** (see FIGURE 2) are located, one on either side of the column member **12** and have their ends joined to the adjacent frame members **36**. The uppermost pair of cross members **38** are joined together by a plate **39** on the underside of which is mounted a steady bearing **40** in which is journalled the upper end of the drive shaft **10**.

The upper flange **20** of the uppermost section of the column **12** is secured to the shaft **10** by means of a collar **41** (see FIGURE 1).

The downward thrust of the whole machine is taken up in a lower thrust bearing **42**.

A pulp discharge scroll **43**, provided for each table unit A, is mounted on a shaft **44** supported in bearings **45** and **46** which, in turn, are mounted on the frame and cross members **37** and **38** respectively. These discharge scrolls **43** are disposed at right angles to the axis of rotation of the table members **11** and, as is shown more clearly in FIGURE 9, are located immediately above the top surface of the screen **18**. A scroll guard **47** (see FIGURES 2 and 4) located on one side of each of the scrolls **43** serves to pick up the filtered pulp from the screen **18** and prevents pulp from being carried past its associated scroll **43** by the rotating screen **18**.

Each discharge scroll **43** has its own individual motor **48** and is rotated by means of a drive **49** connecting the motor **48** with the end of the scroll shaft **44** (see FIGURE 3).

A pulp discharge chute **50** (see FIGURES 1–3, 9 and 10) is located vertically alongside the outer periphery of each table member **11** and opposite the outer end **51** (see FIGURE 2) of each discharge scroll **43** thereby to receive the pulp from the scrolls and to carry it downwardly for storage or further treatment.

The pulp stock is fed to each of the table members **11** through a stand pipe **52** (see FIGURE 2) and a branch pipe **53** and thence to a pressure head box **54**. The pressure head boxes **54** are designed to distribute the pulp stock evenly on the screens **18** from adjacent the column members **12** to the peripheral edge of the table members **11** and are located adjacent the scroll guard side of the discharge scrolls **43**. The head boxes **54** are each equipped with a variable slice **55** (see FIGURE 8) adapted to control the area of the discharge opening **56** of the head box.

Wash water headers **57**, **58**, **59** and **60** are located at spaced intervals, as shown in FIG. 2, to feed wash water and recycled liquor through nozzles **61** on to and through the pulp stock spread on the screen **18**.

During any wash cycle fresh wash water is applied through header **60** and drained through outlet **29** of the clearance valve **24**. This liquor is then applied through a stand-pipe **64** (see FIGURE 2) onto header **59** and after passing through the pulp passes out through valve outlet **28**. This liquor is then pumped to a stand-pipe **63** and out through header **58**. This liquor will then emerge from valve outlet **27** and is reapplied through stand-pipe **62** to header **57**. Strong liquor will then report from valve outlet **26** to strong black liquor storage. The motion of pulp is in the opposite direction and this gives continuous counter-current washing.

A screen cleaning shower header **66** (see FIGURE 2) is located between each scroll **43** and the head box **54** is supplied with strong black liquor from pipe **67**.

In operation, each table unit A is assembled complete with its associated table member **11**, supporting framework, discharge scroll **43** and wash headers. The lowermost unit A is mounted, through its supporting framework, on pedestals **68** (see FIGURE 1) while the clearance valve **24** is adjusted above the supports **33**. The drive shaft **10** is then coupled to the drive **6** through a coupling **69**. Subsequent table units A are then added, one above the other to the desired number of units. The topmost unit is then completed by mounting the steady bearing **40** for the upper end of the drive shaft **10**.

A single clearance valve unit **24** is sufficient to handle the drainage from each of the table units as the location of the headers over each table are vertically aligned with each other and the drainage water passes down through the drainage passages **23** which are common to the sectors **15** of the tables served by each individual header.

Pulp stock is fed from the pressure head box **54** and its flow on to the screen **18** is controlled to ensure absolute uniformity of pulp distribution across the wire area. Each table is fed and discharged independently, and counter-washing of pulp up to four stages will be carried out on each table. All washing is by displacement, none by dilution and the strong liquor and filtrate stages are separated by the automatic positive clearance type valve **24** located at the base of the centre shaft **10**.

A machine of the type above-described can be expanded to handle additional tonnage without an increase in floor space or mechanical drive facilities, and the operation of increasing the capacity by the addition of one or more units A can be carried out with a minimum of shut-down time.

I claim:

1. A table filter washing machine including a plurality of units aligned vertically one above the other, each unit including a stationary supporting structure, a substantially horizontal screen rotatable about a vertical axis, and radially extending walls associated with and rotatable with the screen and defining a series of washing sectors, the filter screens and radially extending walls of the units being coupled together for rotation in unison, means to continuously supply stock to be filtered and washed to each screen, central drainage means surrounded by said screens and having a series of vertically-extending drainage passages into each of which filtrate from vertically aligned sectors drains, discharge means for removing filtered and washed solids from each screen, said screens each being co-axially mounted about and secured to a central column member, each said column member being vertically aligned with and coupled to the underlying

column member to form a central column, each column member having a plurality of radially extending webs defining said drainage means, and a drive shaft passing co-axially through the central column, said webs extending radially outwardly from the drive shaft, and the drive shaft including a plurality of vertically-aligned coupled sections, one for each column member.

2. A table filter washing machine according to claim 1 including filtrate re-circulating means connected to the central drainage means to receive filtrate from sectors at a particular angular position and to supply said filtrate to vertically-aligned sectors at another angular position.

3. A table filter washing machine according to claim 2 wherein said central drainage means is secured to and rotates with said screens, and said filtrate re-circulating means includes a rotary valve co-operating with said

drainage passages to collect filtrate from vertically-aligned sectors at said particular angular position.

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U.S. Cl. X.R.

210—216, 327, 344