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FEED MEANS FOR A REFINER

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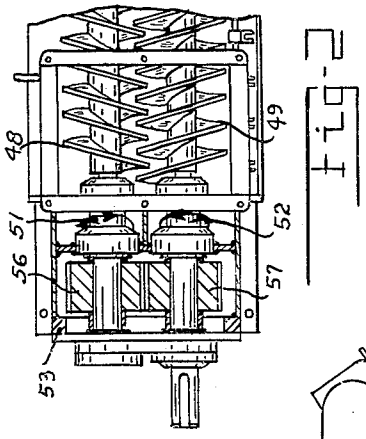

Fig-2

Fig-1

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FEED MEANS FOR A REFINER

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Continuation of application Ser. No. 77,359, Dec. 21, 1960. This application Feb. 27, 1963, Ser. No. 261,919
11 Claims. (Cl. 241—247)

This invention relates to refiners and like devices as used in fiber treatment processes to carry out a milling or like operation upon fibrous stock, the invention having particular reference to stock consistency control in a device as described. This application is a continuation of co-pending application Serial No. 77,359, filed December 21, 1960, now abandoned, the benefit of such filing date being claimed herein.

In systems subjecting plant fibers and the like to treatment in successive stages and by separated pieces of apparatus, the fibrous material may be mixed with a liquid or combination of liquids. The liquid may serve a purpose in softening and treating the fibers but in addition to this forms with the fibers an essentially fluid stock which can be moved readily by pumping to and from successive treatment stages. In some process steps, however, as in disc mill refining, a low consistency stock seriously reduces milling efficiency. Most fibrous materials can be best refined at consistencies too high to admit readily of pumping or gravity flow. Problems of stock handling and feeding accordingly are introduced which it is an object of this invention to obviate.

The object of the invention is to simplify the construction as well as the means and mode of operation of refiners, whereby such refiners may not only be economically manufactured, but will be more efficient and satisfactory in use, adaptable to a wide variety of applications, and be unlikely to get out of order.

Another object of the invention is to reduce low consistency stock to a predetermined high consistency in conjunction with and as a part of a continuous feeding of the stock to the refiner.

A further object of the invention is to provide a refiner having feed means therefor expressing excess liquid from the supplied stock.

Still another object of the invention is to locate in the stock inlet duct to a refiner or the like, stock feed means operable to enforce draining of liquid from the stock and to regulate such drainage.

A still further object of the invention is to provide for removal or excess liquid from stock fed to a refiner or the like and the recombining of such liquid with the stock issuing from the refiner.

A further object of the invention is to provide a refiner possessing the advantageous structural features, the inherent meritorious characteristics and the mode of operation herein mentioned.

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 consists 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 the best mode presently contemplated of carrying out the invention but obviously not necessarily the only form of embodiment of the invention,

FIG. 1 is a partly diagrammatic view of a refiner incorporating stock handling and feeding means in accordance with the illustrated embodiment of the invention; and

FIG. 2 is a fragmentary plan view of the inlet end of the refiner supply duct, partly broken away to show the construction and mode of driving positively acting feed devices in the supply duct.

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

Referring to the drawing, the invention is illustratively disclosed as a part of refiner means including a double disc revolving mill of a kind operable upon plant fibers, as for example to fiberize wood pulp or to extract starch from corn fiber by impact.

As shown, the refiner means includes a refiner housing **10** within which is a pair of relatively rotatable discs **11** and **12**. The discs are in face to face relation and mount respective sets of work performing plates **13** and **14**. In the present instance both discs rotate, in directions counter to one another, and to this end are mounted upon individual shafts **15** and **16** respectively driven by motor means **17** and **18**. The latter, as well as the housing **10**, have a common mounting upon a base **19**.

The material to be refined is introduced into a space **21** between the discs **11** and **12** near the center thereof. As a result of disc rotation the material works its way radially outward between the sets of plates **13** and **14** and is discharged at the periphery of the discs into the housing **10** from which it leaves by way of an outlet opening **22** in a manner indicated by the arrow **23**. Entrance to the space **21** is gained through a series of lateral openings **24** in the disc **12** (only one of which shown) and this opening or openings in turn communicate with inlet means in the form of a fitting **25** installed in the housing **10** to form a part thereof. The fitting **25** communicates with one end of duct means **26** through which the material to be refined is continuously supplied to the refiner housing **10** in the operation of the system.

In accordance with the instant invention the fibrous material reaching the inlet fitting **25** is in a relatively dense form best suited to effective milling. The material as supplied to the duct means **26**, however, is a low consistency mixture of liquid and solids drawn, for example, from a head box **27** which may be in turn fed from another process stage or directly communicated with a storage chest **28**. As indicated, a pump **29** may be driven by a motor **31** to draw stock from the chest **28** and direct it by way of conduit **32** to the head box **27**. An excess supply to the head box results in overflow through a fitting **33** and return to the chest **28** by way of a conduit **34**. Within the head box **27** the low consistency stock has access to a standpipe **35** which projects from the lower end of the box into an inlet opening **36** at the other end of the described duct means **26**. In the operation of the system, therefore, a continuous movement of low consistency stock takes place by gravity flow from the head box **27** to the duct means **26**.

The duct means **26** is supported in part by a stand **37** and in part by fitting **25**. It comprises a housing **38** at one end of which is the inlet opening **36**. At the opposite end of the housing **38** is an enclosed adapter section **39** which in turn is connected to a lateral boss **41** on a further enclosed section **42** inclining downwardly toward the inlet fitting **25** and connected thereto. Extending longitudinally through the housing **38** is a cage comprised in part of a series of longitudinally extending rods **43** (some of which are omitted from the drawing) and longitudinally spaced apart arcuate members **44** which cooperate to form drainage slots from the cage. The described cage makes up a screen section **45** within the housing **38** and through which fluid may escape into a surrounding space **46** within the housing and in turn be led away from the duct means by a drain connection **47**.

The screen section **45** encloses twin intermeshing feed screws **48** and **49** (FIG. 2) on respective shafts **51** and **52**. The latter have bearings in an end wall **53** of housing **38**, in a bearing plate **54** at the opposite end of the housing

and in intermediate walls including a wall **55** suitably formed for a free movement of fluid therethrough. On the shafts **51** and **52** are meshing gears **56** and **57**. Shaft **52** extends through and beyond wall **53** and has driven connection through belt means **58** with a motor **59** supported by stand **37**. In response to the operation of motor **59**, therefore, the shafts **52** and **51** are rotated, in directions counter to one another, and the feed screws **48** and **49** on the shaft correspondingly are rotated. The feed screw configurations on the respective shafts overlap with the result that mating portions of the screws closely approach one another in a manner to compress material carried on and by the screws.

The inlet opening **36** to the housing **38** is common to the screen section **45** so that the low consistency stock from the head box **27** is brought directly to the screen section of the duct means and discharged upon the screws **48–49** at one end thereof. The hydraulic head of contained liquid in the stock forces a part of the liquid directly through the drainage slots of the screen section and into the space **46** where it is carried off by drain connection **47**. Additionally, however, in response to rotation of the feed screws **48** and **49** the stock is at once fed or advanced axially toward adapter **39** and is compressed between the overlapping edges of the feed screws to express additional amounts of liquid which similarly is carried off by the drainage connection **47**. The adapter **39** provides a reduced cross-sectional area into which the thickened or higher consistency stock is fed by the screws **48** and **49**. In such adapter extensions **61** (one shown) of the feed screws **48–49** pick up the stock and advance it positively therethrough into the section **52**. There the stock may drop by gravity to the inlet fitting **25** or, as here illustrated, may encounter further feed screw means **62** longitudinally disposed within the section **42** in a manner to restrict movement of the stock into such section and to advance the admitted stock in a positive manner to the fitting **25**. The feed screw means **62** is separately operated from a motor **63** and transmission **64** with provision being made to control its speed of operation independently of that of the feed screws **48–49** and **61**.

In the operation of the feeding devices, therefore, a low consistency stock is admitted to the refiner supply duct, and in the course of movement to the refiner, is thickened by an enforced release of liquid so that there is delivered to the refiner a stock of higher consistency which on account of its more dense character is refined more effectively and with a lower consumption of power. Additionally, because of the positive and uniform rate of feed a more uniform end product results from the action of the refiner.

The rate of extent of drainage is subject to regulation in various ways, as by a predetermined sizing of the drainage slots in the section **45** as well as by the selection of a predetermined compression ratio of the screws **48–49**. Also, and in the absence of the feed means **62** in section **42**, the helical press as defined by the feed screws **48–49** and associated parts may be operated at varying speeds to provide regulation of drainage. With the feed means **62**, however, a simplified more infinitely variable regulation means is provided since by changing the speed of rotation of the feed screw means **62** the back pressure exerted upon the drainage section may be altered at will with a consequent direct change upon the pressures exerted in the screen section **45**. Through the use of the feed means **62** in section **42** the resistance to movement of the stock out of the press or screen section **45** may be varied from zero to relatively high pressures in the magnitude of several hundred pounds.

The discharge of the refined solids from the housing **10** may be directly to a storage chest or place of use. In the event of continuing process treatment, or in the event it should be desirable for any other reason, the liquid drained from the supply duct **26** may be recombined with the output of the refiner by extending the drainage connection **47** in the manner indicated by the arrow to communicate with the discharge side of refiner outlet **22** as indicated by a joining of the arrows **23** and **65**.

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 statute 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 our invention, we claim:

1. A refiner, including a pair of relatively rotatable discs in face to face relation, means defining an inlet to the space between said discs, a continuous duct delivering to said inlet stock in the form of a mixture of a liquid and solids, said duct including a screen section, an enclosed section beyond said screen section and a relatively reduced diameter intermediate adapter section, helical press means in said screen section accomplishing a predetermined thickening of the stock and advancing it into said adapter section, said helical press means including a pair of counter rotating shafts and feed screw configuration on said shafts overlapping so that mating portions of the screws cooperate to compress material carried thereby, feed screw means in said adapter section advancing the thickened stock into said enclosed section, and additional feed means in said enclosed section, said last named means including drive shafts having means in connection therewith for drive thereof independently of said counter-rotating shafts and being operable thereby to control the rate of stock feed to the space between said discs and to simultaneously produce a selective back pressure on the stock in said screen section.

2. A refiner for fibrous material including, a housing, an inlet and outlet for flow of fibrous stock therethrough, relatively rotatable refiner means in said housing between which said stock must pass in flow therethrough, continuous duct means one end of which connects to said inlet in a closing relation thereto, means defining an inlet for introducing stock having the form of a mixture of liquids and solids of fibrous character in the other end of said duct means, a screen providing a first portion of said duct means, helical press means in at least a portion of said duct means in communication with said screen, said helical press means being arranged to receive stock from said duct inlet and convey the stock in the direction of said housing inlet with a compressing action thereon to express liquid therefrom to exit through said screen, the portion of said duct means beyond said first portion being formed to provide a closed passage for movement of stock therethrough to said housing inlet under the influence of said helical press means and rotatable feed means in a portion of said duct means beyond said first portion having means in connection therewith for operation thereof independently of said helical press means to simultaneously control the rate of stock feed thereto and outwardly therefrom to said housing inlet.

3. In a refiner having a housing and relatively rotatable discs in spaced apart relation therein, an inlet to the space between said discs, an outlet therefrom, a stock preparation and control unit connected to said inlet including a stock thickener portion in which excess liquid is removed from the stock prior to passage of the stock through the inlet, and a stock flow control portion positively regulating the rate of flow of stock to the inlet and in closed communication therewith, said flow con-

trol portion incorporating stock feed means having means in connection therewith rendering it operable to control the rate of stock feed to said inlet and, simultaneously, to produce a variable back pressure in said stock thickener portion to influence the amount of liquid removed from the stock prior to passage thereof through said inlet, the construction and arrangement being such that the stock intermediate the relatively rotatable discs is controlled both as to consistency and quantity by said stock preparation and control unit.

4. A refiner, including a pair of relatively rotatable discs in face to face relation, means defining an inlet to the space between said discs, a duct delivering to said inlet stock in the form of a mixture of a liquid and solids, said duct having a screen section, an enclosed section beyond said screen section and a relatively reduced diameter intermediate adapter section, helical press means in said screen section accomplishing a predetermined thickening of the stock and advancing it into said adapter section, said helical press means including a pair of counter rotating shafts and feed screw configurations on said shafts overlapping so that mating portions of the screws cooperate to compress material carried thereby, and feed screw means in said adapter section advancing the thickened stock into said enclosed section, said last named means including shafts having the form of extensions of said counter rotating shafts and feed screw configurations thereon, said enclosed section communicating directly with said inlet, and positive feed means in said enclosed section operable independently of the operation of said helical press means to produce a back pressure on the stock in said duct whereby to control the degree of compressing action thereon.

5. A refiner, including a refiner housing having an outlet, material refining means in said housing, a fitting constructed as an inlet for admitting material for refining into said housing, enclosed duct means extending to and communicating at its one end with the interior of said housing through said fitting, rotary feed screw means in said duct means, an adapter housing segment connected to and opening into said duct means near its other end, feed screw means in said adapter housing segment, other duct means connected to and leading to said adapter housing segment, said other duct means being gravity drained and having an inlet to receive a mixture of liquid and material for refining, the hydraulic head of the contained liquid forcing a part thereof to pass directly from said duct means, helical press means in said other duct means advancing material for refining into said adapter housing segment while expressing remaining liquid therefrom, said helical press means being in rotary driving relation to the feed screw means in said adapter housing segment, and independent means for rotating said rotary feed screw means in the first said duct means.

6. A refiner, including a refiner housing having an outlet, material refining means in said housing, a fitting constructed as an inlet for admitting material for refining into said housing, said fitting having an upwardly and outwardly facing opening defining said inlet, enclosed duct means extending upwardly and outwardly from said fitting as an extension of said inlet, other duct means extending to and communicating with the first said duct means and having an inlet to receive a mixture of liquid and material for refining, a portion of said other duct means beneath said inlet thereto being constructed as a screen, the hydraulic head of contained liquid forcing a part thereof to pass directly through said screen, and rotary feed means in said other duct means advancing material for refining into said first duct means while expressing liquid therefrom, the material reaching said first duct means being free to drop therethrough by gravity to the interior of said housing containing said refining means.

7. A refiner according to claim 6, characterized by other rotary feed means in the first said duct means effecting a forced feeding of material for refining to said housing, the two said rotary feed means being subject to independent operation.

8. A refiner, including a refiner housing having an outlet, material refining means in said housing, a fitting constructed as an inlet for admitting material for refining into said housing, said fitting having an upwardly and outwardly facing opening defining said inlet, enclosed duct means extending upwardly and outwardly from said fitting as an extension of said inlet, one end of said duct means communicating with the interior of said housing through said fitting, an adapter housing segment connected to an opening into said duct means near its other end, twin feed screws disposed in said adapter housing segment to advance material for refining into said enclosed duct means, said feed screws being disposed in a plane common to the axis of each which is in a transverse angular relation to the axis of said enclosed duct means, and means for continuously supplying said feed screws with material for refining, the material reaching said enclosed duct means from said twin screws being free to drop therethrough by gravity to the interior of said housing containing said refining means.

9. A refiner according to claim 8, characterized by other rotary feed screw means located in said enclosed duct means in the axis thereof for effecting a forced feeding of material for refining to said housing while exerting a variable back pressure upon the movement of such material into said enclosed duct means by said twin feed screws.

10. A refiner according to claim 8, characterized by other duct means enclosing said last named means and having an inlet to receive a mixture of liquid and material for refining, a portion of said other duct means beneath said inlet thereto being constructed as a screen, the hydraulic head of contained liquid forcing a part thereof to pass directly through said screen.

11. A refiner, including a pair of relatively rotatable discs in face to face relation, means defining an inlet to the space between said discs, a duct delivering to said inlet stock in the form of a mixture of a liquid and solids, said duct having a screen section, an enclosed section beyond said screen section and a relatively reduced diameter intermediate adapter section, helical press means in said screen section accomplishing a predetermined thickening of the stock and advancing it into said adapter section, said helical press means including a pair of counter-rotating shafts and feed screw configurations on said shafts overlapping so that mating portions of the screws cooperate to compress material carried thereby, and feed screw means in said adapter section advancing the thickened stock into said enclosed section, said last-named means including shafts having the form of extensions of said counter-rotating shafts and feed screw configurations thereon, said enclosed section communicating directly with said inlet, means in said enclosed section operable independently of the operation of said helical press means to produce a back pressure on the stock in said duct whereby to control the degree of compressing action thereon, said duct being characterized by a stock inlet overlying said screen section, the hydraulic head of the contained liquid in the delivered stock forcing a part thereof to pass directly through said screen section.

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J. SPENCER OVERHOLSER, *Primary Examiner.*