April 29, 1969 C. D. FISHER 3,441,227

REFINER FEEDER

Filed Dec. 22, 1966 Sheet 1 of 2

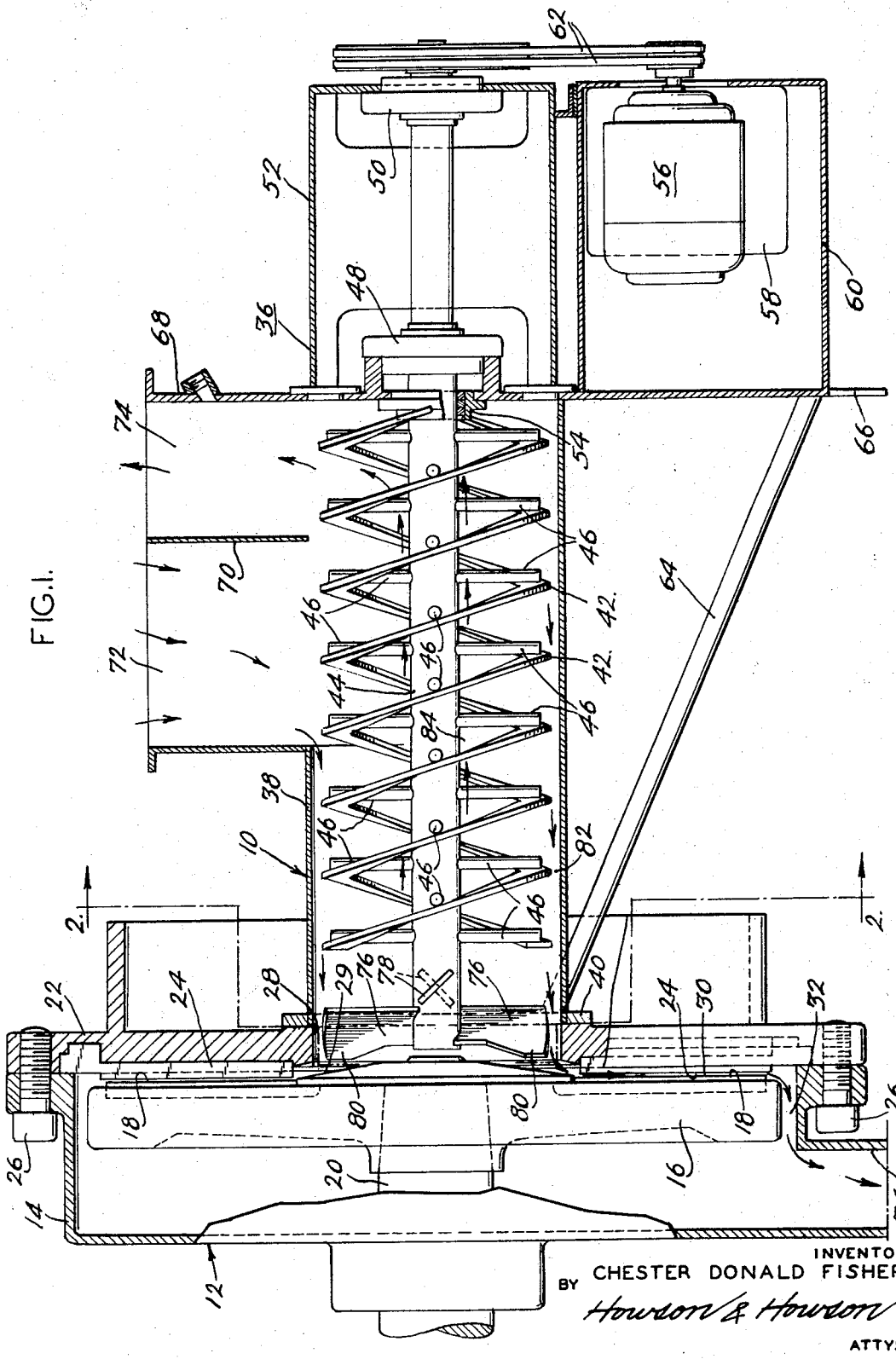


FIG. 1.

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REFINER FEEDER

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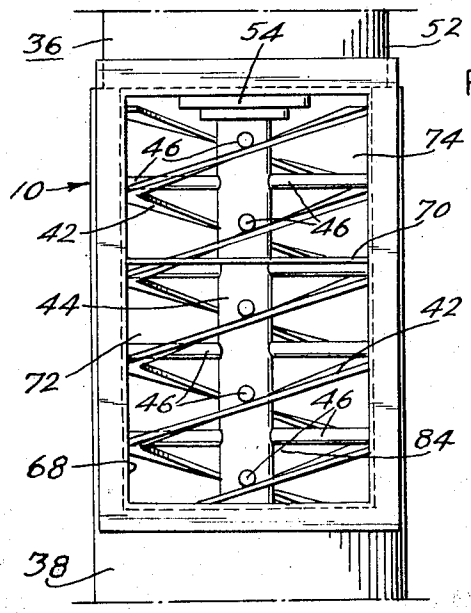


FIG. 3.

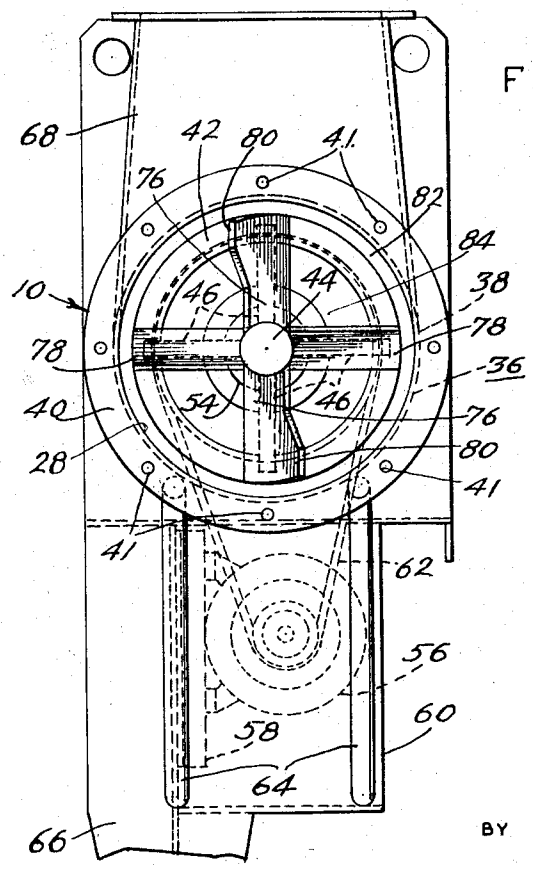


FIG. 2.

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3,441,227

# REFINER FEEDER

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Int. Cl. B02c 23/02
U.S. Cl. 241—247 9 Claims

## ABSTRACT OF THE DISCLOSURE

A throat screw feeder for use with disc type paper pulp refiners in refining high consistency stock characterized by a ribbon-type screw rotated to advance the stock into the refiner throat while permitting a steam backflow from the refiner within the ribbon screw without interference with the stock flow.

The present invention relates generally to stock feeding devices for disc-type paper pulp refiners and relates more particularly to a refiner feeder particularly adapted for feeding high consistency groundwood stock into a disc refiner.

It has been conventional practice to utilize a helical feed screw to advance unrefined stock from a supply reservoir into the refining zone of a disc-type paper pulp refiner. The conventional feeder utilizes a solid feed screw to advance the stock into the refiner and this construction has worked satisfactorily with low consistency stock, there being a sufficiently high stock water content to dissipate the heat generated during the refining operation without the formation of troubesome quantities of steam.

However, in groundwood refining wherein the stock has a very low water content, the water present is transformed into steam by the refining heat and a sufficient steam pressure forms to interfere with the stock feed. Although much of the steam passes out of the refiner with the refined stock, a substantial amount of steam discharges back through the refiner feed screw and; with conventional solid feed screws, interrupts the chip flow to the refiner. The feed interruptions cause severe variations in the refiner load which have a serious detrimental effect on the pulp quality. In addition, the load variations result in severe surges by the refiner drive motor which may be in order of several hundred horsepower with the result that the refiner must be operated at an average load sufficiently below the motor capacity to allow for the power surges. The present refiner feeder has thus been developed to improve the pulp quality and to allow efficient full power operation of the refiner when high consistency stock is being processed.

In the present feeder, provision is made for the escape of steam back through the feeder by employing a high speed ribbon feeder, the high speed operation of which holds the stock around the periphery of the feeder housing, permitting the steam to flow back through the open central region of the feeder along the ribbon drive shaft. By removing the steam from the feeder at a point axially outward of the stock input, the steam does not interfere with the stock flow and a uniform feed rate can be attained to permit a uniform high quality refining operation at full refiner power.

In view of the above it can be understood to be a first object of the present invention to provide an improved refiner feeder for disc-type refiners particularly adapted for refining high consistency stock without feed interruptions.

A further object of the invention is to provide a refiner feeder as described having means permitting steam escape from the refiner through the feeder without interfering with stock inflow to the refiner.



Another object of the invention is to provide a refiner feeder as described adapted to provide an improved pulp quality and refiner efficiency.

A still further object of the invention is to provide a refiner feeder as described of a sample, efficient construction which may be economically manufactured and maintained.

Additional objects and advantages of the invention will be more readily apparent from the following detailed description of an embodiment thereof when taken together with the accompanying drawings in which:

FIG. 1 is a side elevational view of a refiner feeder in accordance with the present invention showing the feeder mounted on a disc-type refiner, the refiner feeder being shown in section and the refiner being shown partly in section and being partly broken away to indicate the stock flow path therein;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1; and

FIG. 3 is a partial plan view of the refiner looking into the stock inlet and steam discharge passages.

Referring to the drawings, FIG. 1 shows a refiner feeder **10** in accordance with the present invention mounted on a disc-type refiner **12** for advancing high consistency stock thereto. The refiner **12** of conventional construction, includes the casing **14** within which the rotor **16** carrying refining plates **18** is mounted for rotation on the shaft **20**. The feed end of the casing is closed by the swing head **22** which supports the fixed refining plates **24**, the swing head being secured to the casing by bolts **26** during operation of the refiner. Unrefined stock is delivered axially by the feeder through the circular aperture **28** in the swing head into the throat **29** of the refiner and is driven by centrifugal force through the refining zone **30** between the refining plates into the peripheral region **32** of the casing **14** and through the refiner outlet **34**.

The present refiner feeder **10** includes a housing means **36** comprising a cylindrical screw housing **38** coaxial with the refiner and bolted to the swing head **22** by means of the flange **40** having spaced bolt holes **41** therein as shown in FIG. 2. The swing head aperture **28** and the screw housing **38** are of the same diameter to permit a smooth flow of the stock into the refiner. A ribbon feed screw **42** is mounted on coaxial shaft **44** in the screw housing by means of the ribbon support rods **46**, the shaft being rotatably supported by bearings **48** and **50** mounted in the auxiliary housing **52** at the outer end of the screw housing. The auxiliary housing is sealed from the screw housing by means of the stuffing box **54**.

The drive means for rotating the shaft **44** comprises a motor **56** mounted on the adjustable motor base **58** in the motor housing **60**, the motor being connected to the shaft **44** by the belt drive **62**. The housing assembly is stiffened by the diagonal braces **64** and is further supported by means of the support member **66** extending to the refiner base or the floor.

A rectangular flanged duct **68** opens into the outer end of the screw housing **38** from above and includes an axially transverse vertical partition **70** dividing the duct into a stock inlet passage **72** at the inner side of the duct and a steam discharge passage **74** at the outer side of the duct. The flanged duct **68** is adapted for connection with a source of unrefined stock and means for disposing of the surplus steam generated in the refiner.

At the inner end of the feeder shaft **44** closely adjacent the refiner throat are mounted a plurality of inner and outer paddles **76** and **78** adapted to expedite stock flow into the refiner throat. The inner paddles **76** include wing portions **80** conforming with the refiner throat configuration to further the stock feeding action in this region.

The ribbon screw **42** has an external diameter sufficiently smaller than the internal diameter of the screw

housing **38** to provide a clearance **82** therebetween which prevents the binding of wood chips between the ribbon and the housing wall. The interior diameter of the ribbon screw is substantially larger than the diameter of the shaft **44** thus providing an annular passage **84** for steam backflow from the refiner throat **29** to the steam discharge passage **74**, the rotating rods **46** having a negligible retarding effect on the escaping steam.

For operation of the refiner feeder, the flanged duct **68** is connected to a source of high consistency stock and means provided to exhaust steam from the steam discharge passage **74**. With the refiner operating to rotate the rotor **16**, the motor **56** is operated to drive the shaft **44** and attached feed screw **42** and paddles **76** and **78** at a relatively high speed. A typical speed for example with a 14 inch ribbon screw having approximately a 3 inch pitch would by 500 r.p.m. for feeding stock to a 42 inch refiner. The size and pitch of the screw and speed of rotation would, of course, depend on the capacity of the refiner and the consistency of the stock being fed thereto.

The stock entering through the stock inlet passage **72** is picked up by the ribbon screw **42** and, due to the high speed rotation of the screw, is thrown by centrifugal force outwardly against the inner wall of the screw housing **38** and is advanced therealong into the paddles **78** and **76** and into the refiner throat **29** whereupon it is advanced by the centrifugal action of the rotor **16** across the refining plates in the refining zone **30** and out of the refiner through the outlet **34**. Steam generated in the refining zone **30** passes in part out through the outlet **34** but a substantial amount of steam backs up into the refiner throat and into the feeder. With the present feeder construction, due to the use of a high speed ribbon screw which throws the stock to the outside of the screw housing, the annular steam escape passage **84** is kept substantially free of stock permitting a counterflow of steam from the throat **29** along the shaft **44** of the feeder to the outer end of the screw housing **38** and out through the steam discharge passage **74** in the duct **68**. In this manner the escaping steam does not interfere with the stock inflow and the stock is advanced into the refiner throat without interruption.

As an example of the refiner efficiency improvement provided by the present refiner feeder, with a conventional solid screw feeder employed with a 2,000 HP refiner for refining high consistency stock, the interruptions of the stock flow by the steam backflow caused power surges in the range of 200–300 HP with the result that the refiner could only be operated at an average load in the range of 1800–1850 HP. It can thus be appreciated that steam interference with stock flow in a conventional refiner feeder can result in the loss of as much as 10% of the refiner capacity. Even more serious is the problem of poor quality pulp resulting from the interrupted flow conditions.

With the present ribbon type feeder, stock flow interruptions caused by steam backflow are entirely eliminated and the refiner may be run at full power with high consistency stock to produce a uniform quality pulp.

Manifestly, changes in details of construction can be effected by those skilled in the art without departing from the spirit and the scope of the invention as defined in and limited solely by the appended claims.

**1** claim:

**1.** A feeder for advancing high consistency stock into the throat of a disc-type refiner comprising housing means communicating with the refiner throat, a ribbon screw rotatably supported within said housing means, means for driving said ribbon screw in rotation, a stock inlet passage in said housing separate from said stock inlet passage, and a steam discharge passage in said housing, said ribbon screw being adapted to advance high consistency stock from said stock inlet passage to the refiner throat while permitting steam backflow from the refiner to pass within said ribbon screw from the refiner throat to said steam discharge passage.



**2.** A feeder as claimed in claim **1** wherein said ribbon screw is axially aligned with the refiner axis.

**3.** A feeder as claimed in claim **2** wherein said steam discharge passage is located axially outwardly from said stock inlet passage.

**4.** A feeder for advancing high consistency stock into the throat of a disc-type refiner comprising a cylindrical screw housing communicating with the refiner throat and axially aligned with the refiner axis, a shaft coaxially journaled for rotation within said screw housing extending substantially the full length of said housing, a ribbon screw mounted coaxially on said shaft with the inner diameter thereof spaced from said shaft, means for driving said shaft and ribbon screw in rotation, a stock inlet passage in said housing, and a steam discharge passage in said housing separate from said stock inlet passage, said ribbon screw being adaped to advance high consistency stock from said stock inlet to the refiner throat while permitting steam backflow from the refiner to pass between said ribbon screw and said shaft from the refiner throat to said steam discharge passage.

**5.** A feeder as claimed in claim **4** wherein said steam discharge passage is located axially outwardly from said stock inlet passage.

**6.** A feeder as claimed in claim **4** including a plurality of paddles on the inner end of said shaft adjacent the refiner throat for directing and distributing stock into the refiner.

**7.** A refiner as claimed in claim **4** wherein the outer diameter of said ribbon screw is smaller than the inner diameter of said screw housing to provide a sufficient clearance therebetween to prevent binding and jamming of the stock flow.

**8.** A refiner as claimed in claim **4** including a plurality of radial ribbon screw support rods on said shaft for supporting said ribbon screw in spaced relation from said shaft.

**9.** A feeder as claimed in claim **4** wherein said means for driving said shaft and ribbon screw in rotation is adapted to rotate said shaft and screw at a sufficient speed to maintain the stock flow by centrifugal force in the radially outer regions of the screw housing thereby substantially freeing the regions adjacent said shaft from stock flow and permitting steam backflow to pass freely therethrough.


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(5/69)

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,441,227 Dated April 29, 1969

Inventor(s) Chester Donald Fisher

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 17, change "by" to --be--.
Column 4, lines 3 and 4, cancel "separate from said stock inlet passage"; line 5, after the comma (,) insert --separate from said stock inlet passage--.

SIGNED AND
SEALED

OCT 21 1969

(SEAL)
Attest:

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Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents