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BARK FEEDING SYSTEM

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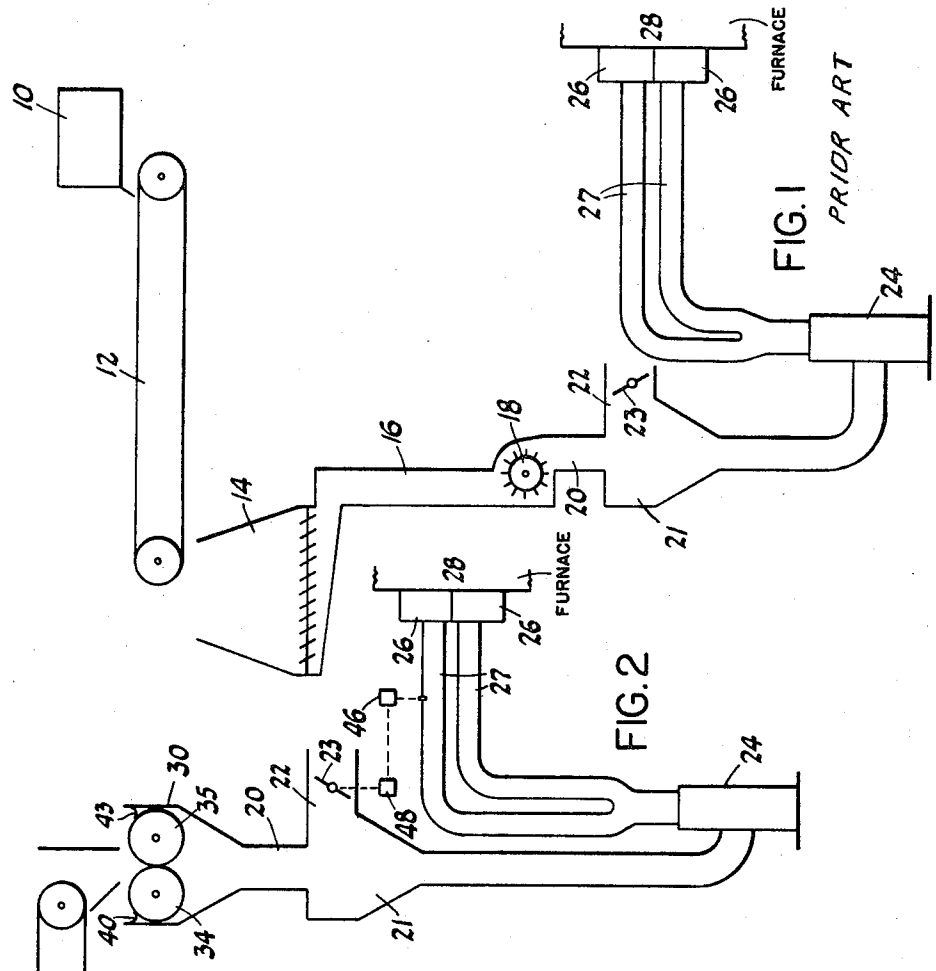

FIG. 1
PRIOR ART

FIG. 2

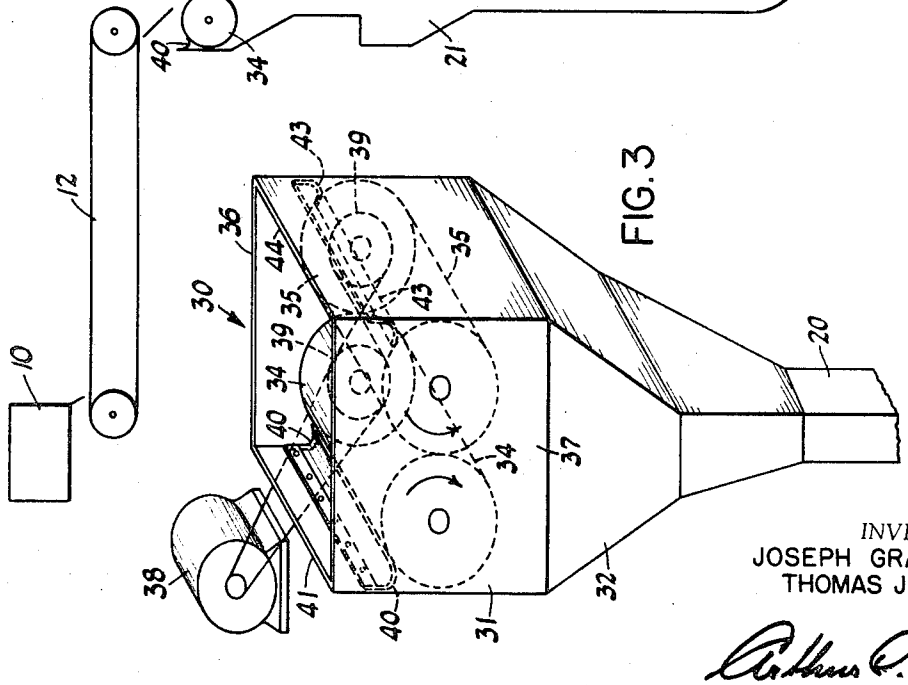

FIG. 3

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BARK FEEDING SYSTEM

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8 Claims. (Cl. 110—102)

ABSTRACT OF THE DISCLOSURE

A system for conveying bark or material of similar character and feeding it to a furnace partially by conveying means using hot air or hot gases with a portion of the path over which the bark travels being maintained the atmospheric pressure. The bark is transferred from the atmospheric pressure portion to the subtatmospheric pressure portion by means of a gate which comprises a pair of large diameter air-filled rotating rollers and sealing means fully occupying the cross section of the bark conveying path, the rollers having a soft, yielding surface maintained in mutual contact to form a seal while the bark passes between the rotating rollers from the atmospheric pressure portion of the conveying path to the subatmospheric pressure portion.

Background of the invention

The invention relates to a system for conveying and feeding bark, bagasse, or other cellulose fuel of similar character and has special reference to improved feeder facilities by the aid of which such bark and other wood-type fuel can be successfully transported partially by air or gas to a furnace for burning and for the generation of steam or other purposes.

The three major problems encountered in suspension firing of bark in furnaces are the uniform feeding of the bark to the bark transport fan, the leakage of cold air into the bark conveying and firing system, and the control of the hot air supplied to the bark transport fans. The principal cause of these problems in feeding bark is the fact that hogged bark is a very difficult material to handle, primarily because it contains "stringers" or long threads of bark that tend to tie the pieces, chips, or slivers of bark together. In addition, these "stringers" have a tendency to wrap themselves around any rotating parts having projections or diameters less than the length of the "stringers."

Summary of the invention

The invention resides in an improved bark feeding facility and has as its objects uniform and trouble-free feeding of the bark to the bark transport fans. This is accomplished by the employment of a pair of large diameter feed rollers preferably being air filled and having a soft, yielding surface which permits the bark to pass between the rollers uniformly and without danger of entanglement. At the same time, because of the yielding character of the rotating surface, a satisfactory seal is maintained between the atmospheric and subatmospheric pressure regions of the bark conveying path.

Brief description of the drawing

Other objects and advantages of the invention will become apparent from the following description of an illustrative embodiment thereof when taken in conjunction with the accompanying drawing wherein:

FIGURE 1 is a diagrammatic representation of a bark feeding system as heretofore used in the art;

FIGURE 2 is a diagrammatic representation of a bark feeding system equipped with the inventive facilities herein disclosed; and

FIGURE 3 is an isometric view showing the duct portion containing the large diameter feed rollers and the sealing strips.

Description of the preferred embodiment

In the drawing, like reference characters are used throughout to designate like elements. Referring now to FIG. 1, an existing bark feeding system as presently known in the art will first be described to facilitate understanding of the invention and of the advantages afforded by its use. The bark received from a storage area (not shown) is hogged in a hogger **10** and delivered by way of a conveyor belt **12** to a live-bottom storage bin **14** from whence the bark is fed into a chute **16**. This chute terminates in feeder **18** which is a drum provided with a great number of projections upon its periphery and is made to revolve at a predetermined speed which determines the quantity of bark per hour delivered by way of chute **20** to the top of cyclone mixer **21**. Hot air or gas is admitted to cyclone mixer **21** through duct **22** and damper **23**. After thorough mixing which serves to remove surface moisture from the bark, the air and bark mixture passes to bark transport fan **24** which delivers the air-suspended bark to burners **26** by way of fuel pipe **27** for burning in furnace **28**.

In the apparatus described above, a negative pressure must be maintained in the portion of the bark travel path between the bark feeder **18** and the inlet to fan **24** in order to prevent bark powder and hot air from blowing out into the surrounding area. For this reason, an air seal must be established to prevent cold air from leaking into the system from the bark feeding end. An attempt is made to provide such a seal by maintaining a head of bark of about 10 feet in chute **16**.

The difficulties encountered in the above-described system are caused primarily by the live-bottom storage bin **14**, the air sealing chute **16**, and the bark feeder **18**. The live-bottom storage bin is subject to frequent plugging due to the mechanical bottom. The tall column of bark maintained in chute **16** intended to form an air seal performs this function only in a haphazard manner, still permitting undesirable leakage of cold air into the system. In addition, this column of bark in chute **16** has an inherent tendency to "bridge" and to plug the inlet to feeder **18**. Feeder **18**, being a rotating drum with projections on its outer surface, has a tendency to become bound with "stringers" and plug. All of the above difficulties cause frequent shutdown of the bark firing system which results in an inefficient operation, costly maintenance and large investment and income losses.

Our improved bark feeding system as illustrated in FIGS. 2 and 3 overcomes the above problems and will now be described in detail. First, the live-bottom storage bin **14** together with motor drives and controls, and air seal chute **16** are completely eliminated. This does away with a frequent source of plugging in live-bottom bin **14** and bridging and plugging in duct **16**. In addition, elimination of these elements from the system will result in a saving in head room, building space and supporting steel. Second, the bark feeder **18** is replaced by a device **30**, later to be described herein in detail, which assumes the function of the air seal of former chute **16** and the function of former bark feeder **18**, without being subject to the disadvantages of these elements. Thus the bark from the hogger **10** and conveyor belt **12** is received by a feeder and air lock device **30** which delivers the bark directly into chute **20**, and cyclone mixer **21**.

Referring now to FIG. 3, showing an enlarged view of feeder and air lock device **30** which comprises a hous-

ing **31** of generally rectangular configuration open at the top for receiving the bark from conveyor **12**, and having a hopper bottom **32** connected to chute **20** leading to a cyclone mixer **21**. Two cylindrical rollers **34** and **35** are closely mounted within the housing **31** between and on opposing side walls **36** and **37**. They are rotated in opposite directions, as indicated by the arrows, by means of a motor drive **38** and suitable pulleys **39**. In accordance with the invention, drums or rollers **34** and **35** are of large diameter, such as 3 feet, exceeding the possible length of "stringers," are fabricated of a rubber fabric or a rubberlike fabric, and are hollow and filled with air at relatively low pressure. The peripheral surfaces of these rollers are soft and yielding and in intimate contact one with the other. As they rotate, the outer upper surfaces converge and grip and pull downwardly the pieces of bark which fall on the rollers from the conveyor belt **12**. Due to the soft, yielding character of the rubber fabric and the internal low pressure, the surface tends to close around the bark pieces and thereby prevents substantial leakage of cold air into the system. To further eliminate such leakage, a rubber seal **40** is provided between the surface of drum **34** and side wall **41** and a rubber seal **43** between the surface of drum **35** and side wall **44** extending throughout the entire length of drums **34** and **35**. This length, which preferably is in the neighborhood of 5 feet, is such that the drum fits snugly between the side walls **36** and **37**.

The position of hot air damper **23** is determined in accordance with the invention by the temperature of the air and fuel mixture entering the furnace by way of burners **26**. For this purpose a temperature measuring device **46** is provided in fuel pipe **27**, which device transmits control impulses representing temperature variations to a controller **48** for the purpose of regulating damper **23**. Thus if the temperature of the fuel and air mixture increases above a predetermined desired amount, the increase causes impulses to be transmitted to controller **48** which will close damper **23** a certain amount. A decrease of temperature, on the other hand, will tend to open damper **23** to permit more hot air to enter cyclone mixer **21**. Such variations in temperature of the air and fuel mixture may be caused by variations in moisture content of the bark entering the system, or by variations in hot air temperature.

From the above it can readily be appreciated that our improved bark conveying system overcomes the three earlier mentioned major problems in the firing of bark or other similar fuel which plagued earlier installations. Thus uniform feeding of bark to the transport fan **24** is now assured, since the possibility of bridging of the bark in an air seal shaft or chute **16** and the resulting plugging and interruption of flow has now been completely eliminated. Furthermore, stoppage of bark delivery due to entanglement of the rotating parts of a live-bottom bin **14** and bark feeder **18** with "stringers" is now practically prevented by the elimination of bin **14** and by the use of feed rollers **34, 35** having large diameters in place of bark feeder **18**. Cold air leakage into the system, another serious problem, is now also greatly alleviated by abandonment of the air seal column **16** and by the use of air-filled feed rollers **34, 35** which have a soft and yielding working surface. Furthermore, hot air control is greatly improved by making the quantity of hot air entering the system now depending upon the temperature of the air and fuel mixture entering the burners **26**.

While the invention has been described herein in connection with the burning of bark, our improved fuel feeding system can with equal benefit be used in connection with other type fuels having similar physical characteristics, such as bagasse or other fibrous or stringy material.

We claim:

1. A system for feeding a fibrous and stringy material to a furnace by mechanical and by gas-supported means, including a material conveying path having a first zone subject to atmospheric pressure and a second zone subject to subatmospheric pressure connected in series with said first zone, and means for conveying the material from said first zone to said second zone, the improvement comprising a rotary air lock feeder interposed between said zones and having a pair of large diameter gas filled feed rollers with soft yielding cylindrical surfaces, means for rotating said rollers in opposite directions, means for urging said rollers into mutual gas sealing contact, said rollers being adapted for receiving said material and passing it between said rollers from said first zone to said second zone.

2. A system as defined in claim **1** wherein sealing means are provided at the outer circumferential periphery of said rollers to seal said first pressure zone from said second pessure zone.

3. A system as defined in claim **1** having means for introducing hot gas into said subatmospheric pressure zone for conveying said material in suspension.

4. A system as defined in claim **3** wherein said subatmospheric pressure zone includes a cyclone means for mixing said hot gas and material to dry the latter.

5. A system as defined in claim **4** wherein said subatmospheric pressure zone includes a material transport fan for creating said subatmospheric pressure and for conveying said hot gas suspended material to said furnace for burning.

6. A system as defined in claim **5** having means for measuring the temperature of said gas-suspended material entering said furnace, and having means for increasing or decreasing the quantity of said hot gases in response to a decrease or increase, respectively, of the temperature of the gas suspended material entering said furnace.

7. A rotary air lock feeder mounted in a duct portion for feeding fibrous stringy material of variable lengths from a first pressure zone to a second pressure zone, the improvement comprising a pair of large diameter rollers, means fo maintaining said rollers in circumferential intimate contact, means for rotating said rollers in opposite directions, said rollers having a cylindrical hollow body filled with an expandable medium and being made of a soft yielding material to form a seal along the common circumferential surface, the diameter of said rollers being larger than the lengths of said fibrous stringy material to prevent entanglement with said material when passing between said rollers from said first to said second zone.

8. A rotary air lock feeder as defined in claim **7** having the additional improvement of sealing strips mounted on opposing interior sides of said duct portion in sliding, yielding and sealing contact with the circumferential periphery of said rotating rollers.

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