May 4, 1954 K. O. LINDGREN 2,677,197

FELT DRYING APPARATUS

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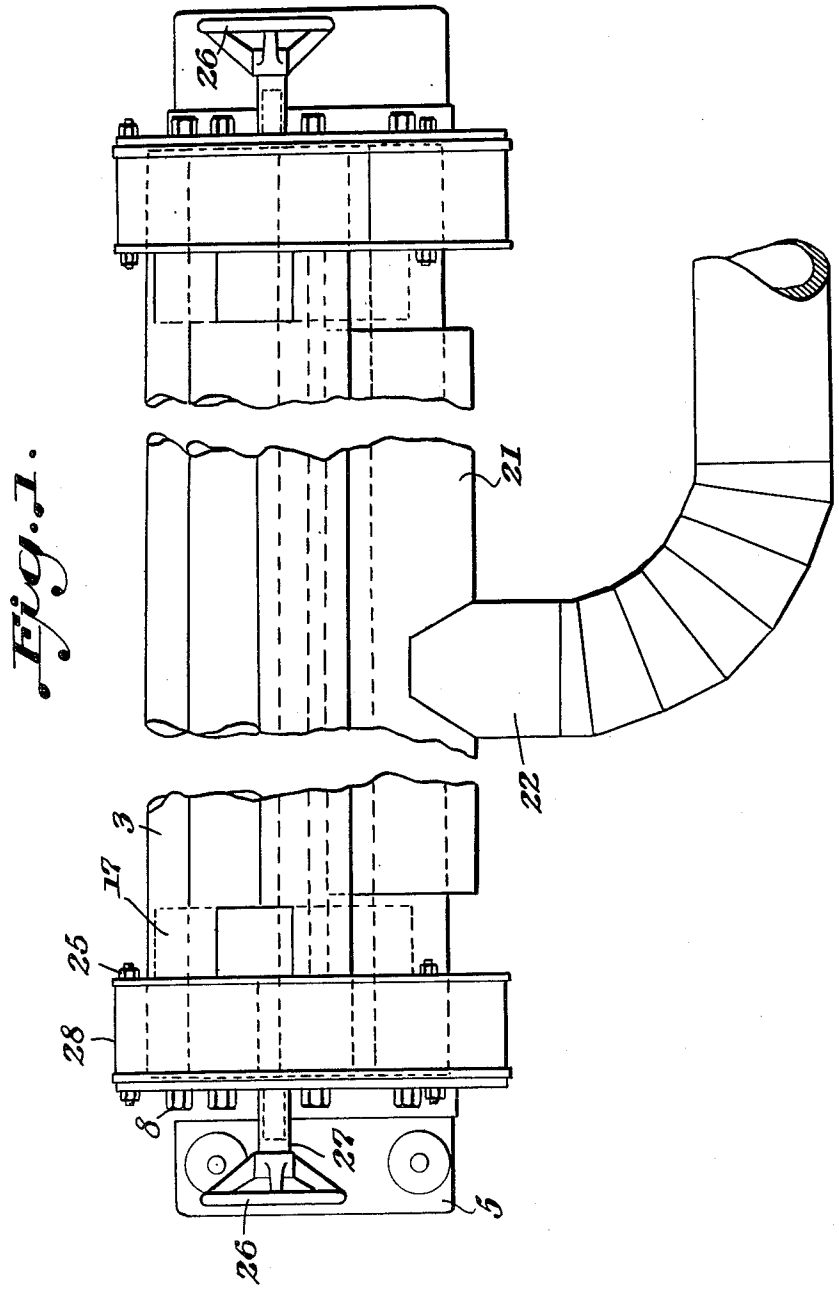


Fig. 1.

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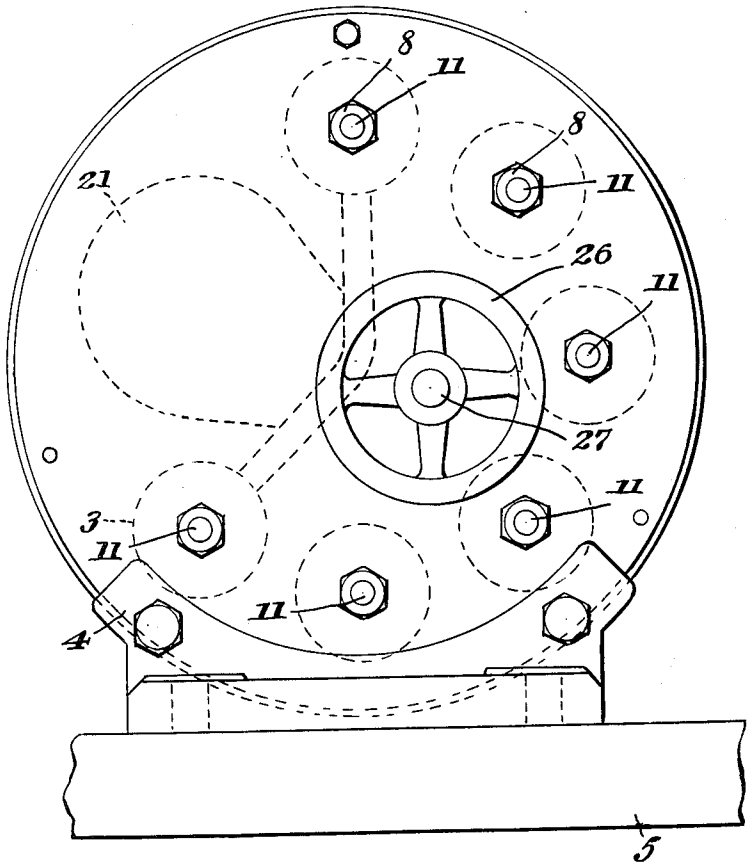


Fig. 2.

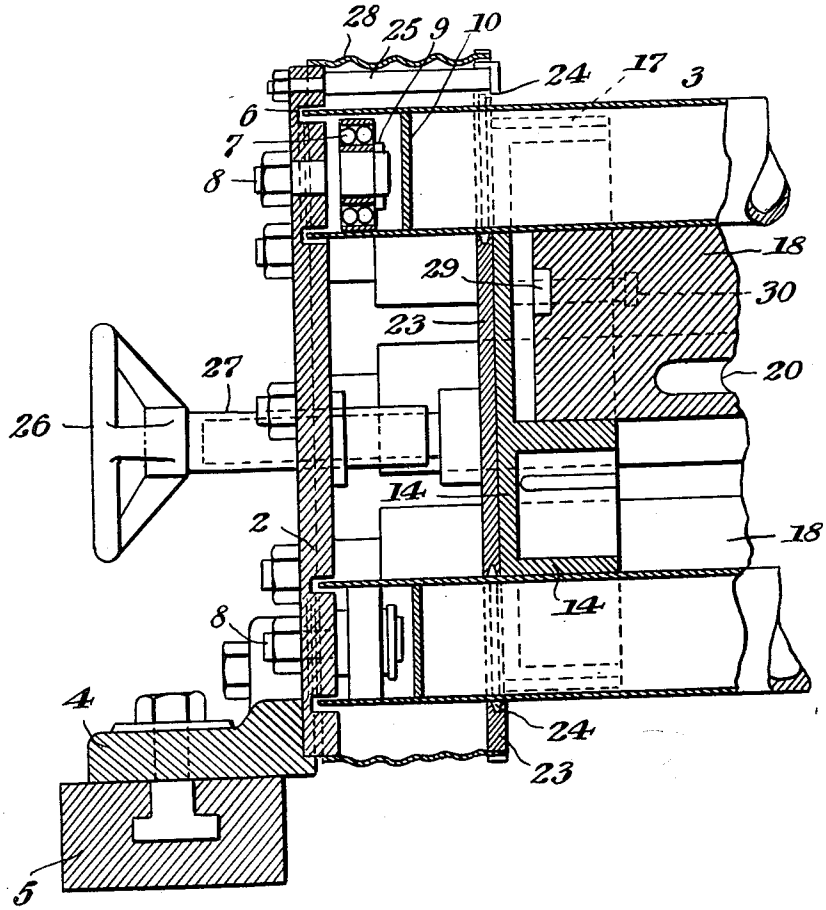
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Fig. 3.



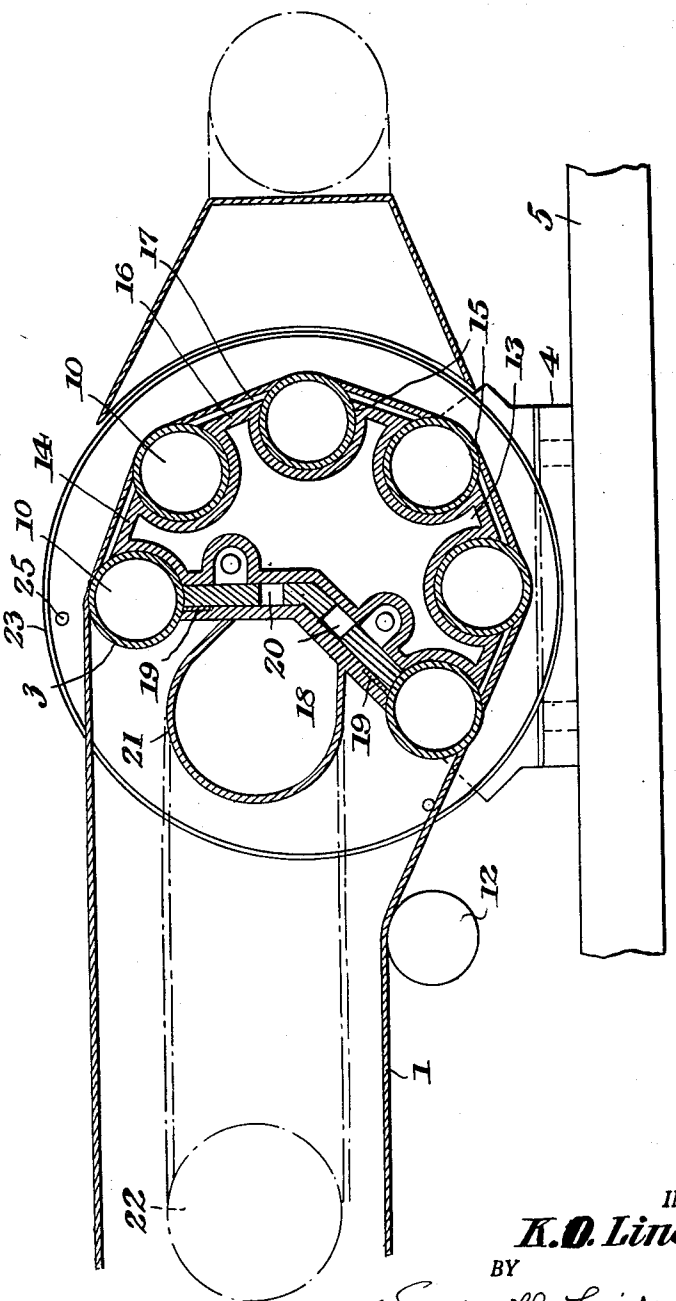
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Fig. 4.



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FELT DRYING APPARATUS

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Application March 4, 1952, Serial No. 274,712

Claims priority, application Sweden March 8, 1951

7 Claims. (Cl. 34—115)

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The present invention relates to felt drying drums for paper-making machines and more specifically to drums of the type including an outer, freely rotatable device, and an inner stationary device which is co-axial with said rotatable device and forms a suction or pressure chamber, said rotatable device consisting of a plurality of parallel cylindrical rolls which are journalled in two supporting end walls comprised in said stationary device, the centers of said rolls being, in a cross-section through said rotatable device, uniformly distributed on an arc, and further including at least one guide roller, when said arc exceeds 180°, to cause the felt to contact all of said rolls.

When paper is produced in paper-making machines the paper web, having a moisture content of about 70 to 65%, is conducted into a drying apartment usually consisting of one or more groups of rotating, heated drums. In the production of most of the existing paper qualities thick endless woolen felt webs, so-called drying felts, are used to press the paper web against the surface of the drying drums. Through this pressing action a favourable heat transfer from the drum to the paper web is obtained, and at the same time corrugation of the paper will be prevented and a glazed paper surface will be obtained, as well as other desirable effects.

The moisture absorbed by the felt upon pressing the paper web against the hot surfaces of the drums must be removed as completely as possible, and the felt is therefore usually conducted over separate steam-heated felt drying drums, although in recent times drying drums of the first-mentioned type have begun to find utilization. For drying the felt the necessary drying drum surface will usually be about 35% of the drum surface necessary for drying the paper web.

The present invention has for its objects to reduce the great and costly need of space necessary according to the felt drying method described in the foregoing, and, in addition, to reduce the heat supply necessary for the felt drying operation, as compared with prior methods, which is attained by increasing the efficiency of the heat transfer, to the drying felt. Since, in prior paper-making machines, the felt drying drum surface is often too small, the insertion of one or more apparatus according to this invention will enable, by a relatively small capital investment, to obtain a materially increased machine capacity.

For the objects stated, according to the present invention, a felt drying drum for paper-making machines of the type described in the beginning of the preamble is mainly characterized by the fact that said rolls are freely rotatable and adapted to be driven by the endless felt web embracing the same, and that said suction or pressure chamber is completely closed, a peripheral wall for this chamber being, in a manner known per se, formed by the portion of said felt web embracing said rolls, and the end walls of said chamber being formed by two end plates, the chamber being at its radially inner portion or bottom connected to a suction or pressure conduit of an air fan which is arranged to draw or feed, respectively, a stream of heated air into said chamber, said airstream causing a vacuum or a super-atmospheric pressure, respectively, in said chamber and drying said felt web when passing therethrough.

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A specific embodiment of the invention will now be described by way of example in conjunction with the accompanying diagrammatical drawings.

In the drawings:

Fig. 1 is a plan view, partly broken away, of the drying drum.

Fig. 2 is an end view of the same.

Fig. 3 is a vertical longitudinal section through one end portion of the drum.

Fig. 4 is a cross-section through the drum intermediate its ends.

The freely rotatable device embraced by the felt web 1 consists of a plurality, in this case six, cylindrical rolls 3 which are mounted in two supporting end walls 2 comprised in the stationary device so as to be freely rotatable therein, said rolls extending in parallel interrelation and forming therebetween sufficiently wide gaps for admitting heated drying air. The supporting end walls 2 are secured to the machine stand 5 by means of brackets 4. In order to accommodate thermal expansion of the rolls 3 upon heating, the ends of the rims of the rolls project endwise into circular grooves 6 provided in the surfaces of the end walls 2 facing said rolls 3 forming therewith a simple labyrinth seal. Each end portion of each roller 3 is mounted on an internal antifriction bearing 7 the inner race of which is rigidly mounted on a stub shaft 8 secured in the end wall 2 and is retained by a locking nut 9, whilst the rim of the roll is, at each end, supported interiorly on the outer race of said bearing so as to be axially displaceable thereon. A sealing and reinforcing diaphragm 10 is secured in the hollow roll 3 opposite the stub shaft 8, for instance by brazing.

The centers 11 of the rolls 3 are, in a vertical

section through the set of rolls, uniformly distributed on an arc, and the angular distance along this arc between the centres of the two extreme rolls has to be at least 180°, said distance being in this instance about 220°. When this arc exceeds 180° a guide roller 12 has usually to be present in order to cause the felt web 1 to contact all of the rolls 3, as indicated in Fig. 4.

The suction or pressure chamber 13 comprises two essentially sector shaped, in axial section cup-shaped end plates or covers 14 the peripheral flanges of which are directed towards each other. The end covers 14 are provided in their peripheral portions with arcuate recesses 15 each one of which substantially sealingly embraces a portion of the periphery of a corresponding one of the rolls 3, as will be best seen in Fig. 4. The outer peripheral surfaces 16 of the end covers 14 situated between said recesses 15 are plane and parallel with a tangential plane to the two adjacent rolls 3. The space between said plane surfaces and the felt web 1 running tangentially over the rolls upon operation of the apparatus is occupied by sealing plates 17 peripherically connecting on to two adjacent rolls and extending axially over said plane surfaces to serve as supports for, and sealing members at, the lateral edges of the felt web 1. The sealing plates 17 may suitably be made of bongo wood or the like.

The bottom of the suction or pressure chamber 13 is formed by a longitudinally extending wall 18 extending radially between the two extreme rolls 3, the ends of said wall passing, with allowance for thermal expansion, in sealing relationship through elongated openings or slots provided in the end plates or covers 14 of chamber 13. Each longitudinal edge of said bottom wall 18 carries a detachable scraper 19 in sealing contact with the corresponding roll 3 (Fig. 4). The bottom wall 18 has provided therein a suitable number of openings 20 capable of passing the necessary rate of air flow, said openings setting the suction or pressure chamber 13 in communication with a manifold or distributor 21 extending along the outside of the bottom wall 18 and to which the suction or pressure conduit 22 of the fan (not shown) is connected.

In order to adapt the effective axial length of the drying drum to the slightly varying felt width, and also to any displacement of the felt web 1 axially along the drum, an adjustment device is provided by which the end covers 14 with the sealing plates 17 for the edges of the felt 1 may be displaced by a sufficient amount longitudinally of the rolls 3. Said adjustment means comprises a plate or the like 23 rigidly attached to each chamber end cover 14 and having a number of circular holes provided with gaskets 24, the rolls 3 projecting through a corresponding one of said holes towards the adjacent one of the supporting end walls 2. Plate 23 is, in addition, provided in its rim portion with a number of guide holes by which the plate is guided on corresponding longitudinally extending guide pins 25 which are rigidly secured to the corresponding supporting end wall 2. To each cover 14 are, in addition, two or more guide pins 30 secured, on which pins 30 guide sleeves 29 rigidly connected to the bottom 18 slide upon axial displacement of said end cover 14. The adjustment means also includes an axially directed adjustment screw provided with an operating wheel 26 and being freely rotatably and longitudinally displaceably connected with the plate 23 and thus with the end cover 14, and being threadedly interengaged with the supporting end wall 2. By turning the wheel 26 in one direction or the other, it will thus be possible to displace the plate 23 with the gaskets 24 and the end cover 14 along the rolls 3 in order to increase or reduce, respectively, the effective length of the drum. To establish satisfactory sealing and dust-tight enclosure of the ends of rolls 3 and other elements, a bellows is tightly secured between the rim of plate 23 and the rim of the supporting end wall 2. To keep constant the position of sealing plate 24 and end cover 14 relative to the lateral position of the edge of the felt web 1, the wheel 26 as shown might be substituted by a sprocket wheel, for example, which could receive operating impulses via a driving chain and, for instance, a servo mechanism from a felt controlling mechanism incorporated in the machine, or from a manually adjustable control drum.

It will be understood that the invention is not restricted to the embodiment described in the foregoing and illustrated in the accompanying drawings since the same is susceptible of various modifications within the scope of the invention defined in and by the appended claims.

What I claim and desire to secure by Letters Patent is:

1. A felt drying apparatus for paper-making machines and including an outer, freely rotatable device to receive embraced thereon an endless felt web to be dried, an inner stationary device in coaxial interrelation with said rotatable device, an air chamber defined within walls formed by said stationary device and by the portion of said felt web embracing and rotatable device when received thereon, air displacement means connected to said chamber for causing an air stream to pass through said portion of said felt web in order to remove moisture therefrom, a plurality of parallel cylindrical rolls forming said rotatable device by being journalled in two supporting end walls comprised in said stationary device, the centers of said rolls being, in a cross-sectional plane through said rotatable device, uniformly distributed on an arc less than 360°, and means for causing said felt web to be pressed into contact with all of said rolls, said rolls being freely rotatable and driven by said endless felt web, said air chamber being completely closed within said embracing portion of said felt web forming its peripheral wall, two opposite end plates forming the end walls of said chamber, and a radially inner wall forming a bottom of said chamber, and an air duct from said air displacement means being arranged to pass a stream of heated air through said chamber wall forming portion of said felt web to dry the same when passing over said rotatable rolls.

2. Apparatus according to claim 1 comprising two substantially sector-shaped, in axial section cup-shaped, end plates or covers having their peripheral flanges directed towards each other, arcuate recesses in the peripheral portions of said end covers, each one of said recesses embracing in substantially gas-tight relation a portion of the periphery of a corresponding one of said rolls, the outer peripheral surfaces of said end covers extending between said recesses being plane and parallel with a tangential plane to the two adjacent ones of said rolls, the space between said plane surfaces and said felt web running tangentially over said rolls being occupied by sealing plates peripherically connected on to adjacent rolls and extending longitudinally over said plane surfaces to serve as supports for, and

sealing members at, the lateral edges of said felt web.

3. Apparatus according to claim 1 in which said suction or pressure chamber includes a bottom wall extending radially outward between the two extreme ones of said rolls, the ends of said wall passing, with allowance for thermal expansion, in sealing relationship through elongated openings or slots provided in said end plates or covers of said chamber, each longitudinal edge of said bottom wall carrying a detachable scraper in sealing contact with the corresponding one of said extreme rolls, and said bottom wall having provided therein a plurality of openings through which said chamber communicates with said suction or pressure conduit of said suction or pressure producing device.

4. Apparatus according to claim 1 comprising adjustment means by which said end plates or covers of said chamber are displaceable longitudinally of said chamber bottom and said rolls, whereby the effective length of said apparatus may be adapted to any variations in the width of said felt web and also to any displacement thereof longitudinally of said rolls.

5. Apparatus according to claim 4 in which said adjustment means comprise a plate rigid with said chamber end cover, said last-mentioned

plate being provided with circular holes each having therein a gasket, said rolls projecting through corresponding ones of said holes towards the adjacent one of said supporting end walls, said plate being further provided with a plurality of guide holes in interengagement with corresponding guide pins rigidly attached to said supporting end wall, and further with an adjustment screw having a control member and being freely rotatably and axially non-displaceably connected with said plate, said screw being threadedly connected with said supporting end wall and passing axially therethrough.

6. Apparatus according to claim 4 comprising bellows means mounted tightly between the rim of said last mentioned plate and the rim of said supporting end wall.

7. Apparatus according to claim 4 comprising follow-up means for actuating said control member of said adjustment screw from a control device comprised in said paper-making machine.

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