United States Patent [19]

Schiel

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[54] **STEAM HEATED DRYER CYLINDER**

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[30] **Foreign Application Priority Data**

Aug. 1, 1973 Germany 2338922

[52] **U.S. Cl.** **34/41;** 34/124; 165/90

[51] **Int. Cl.²** **F26B 3/32**

[58] **Field of Search** 34/119, 122, 124, 14, 125, 34/41, 43, 48, 49; 165/89, 90

[56] **References Cited**

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Assistant Examiner—James C. Yeung
Attorney, Agent, or Firm—Melvin A. Crosby

[57] **ABSTRACT**

A steam heated dryer cylinder, especially for paper-making machines and the like, in which a hollow cylindrical shell is provided which has the inner surface thereof provided with annular circumferential grooves. Steam is supplied to the interior of the cylinder for heating thereof and the condensate from the steam is withdrawn from the aforementioned grooves. Dam-like inserts are provided in spaced relation in the annular grooves to obstruct the circumferential flow of condensate therein and to create intensive turbulence in the condensate thereby to promote even heat transmission over the entire area of the outer surface of the cylinder. The inserts in the annular grooves inside the cylinder are advantageously pressed in position and may range in heighth up to about the level to which condensate collects in the annular grooves.

10 Claims, 13 Drawing Figures

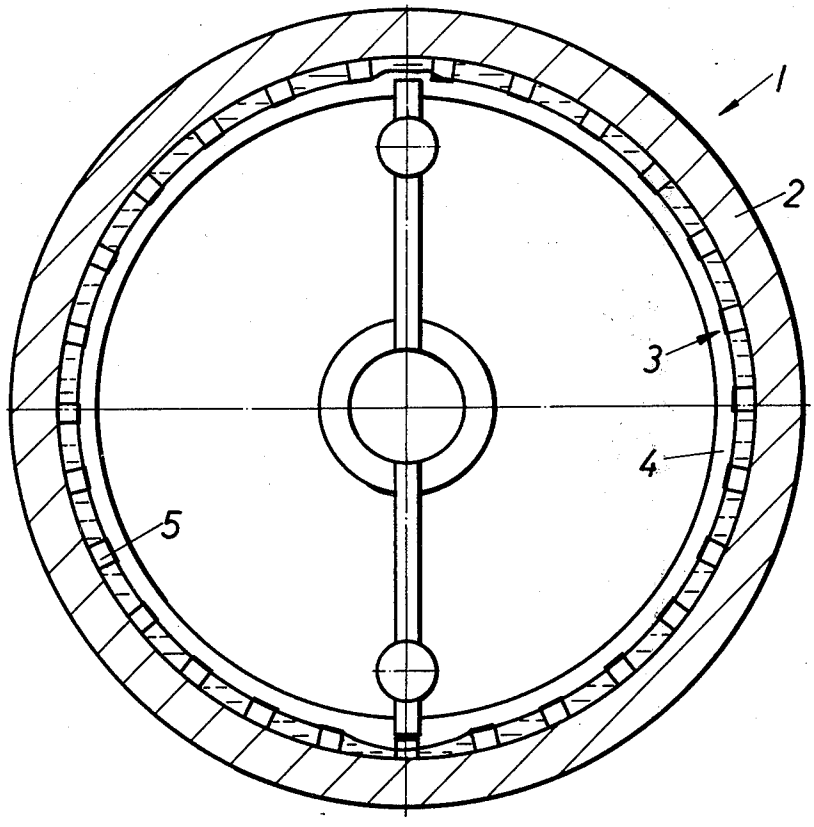


Fig.1

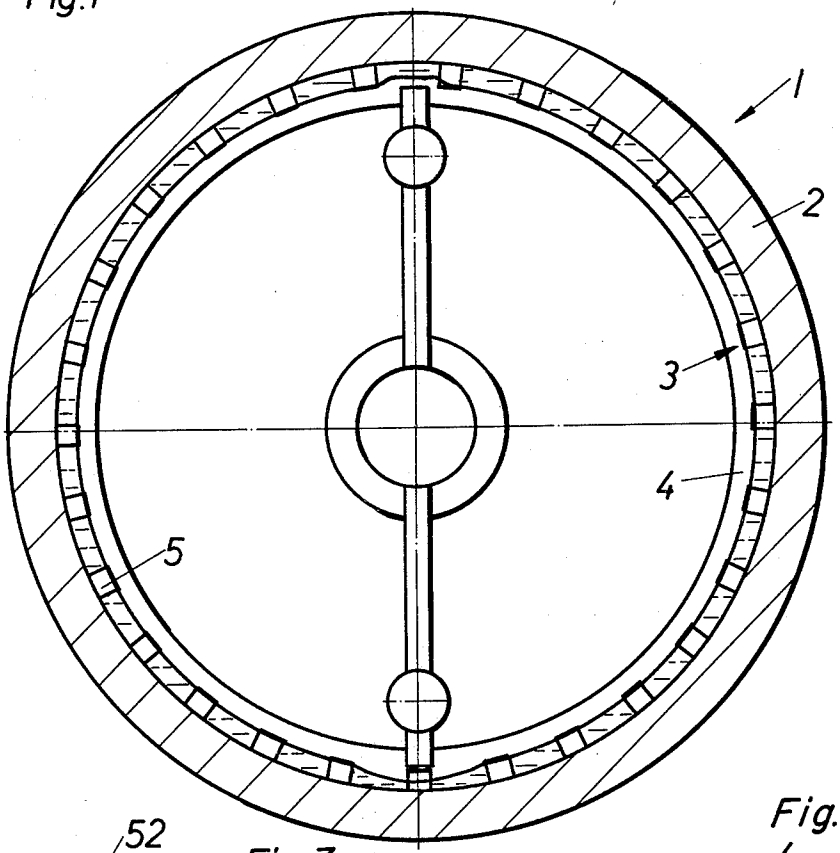


Fig.2

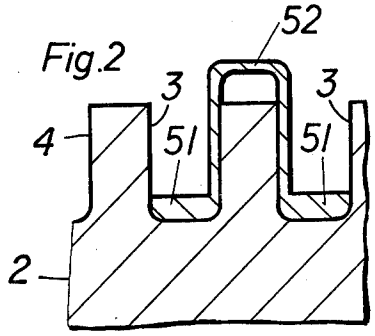


Fig.3

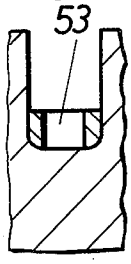


Fig.4

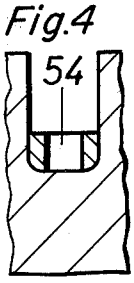


Fig.5

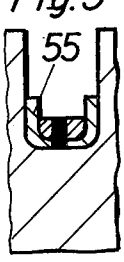


Fig.6

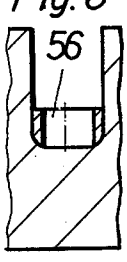


Fig.7

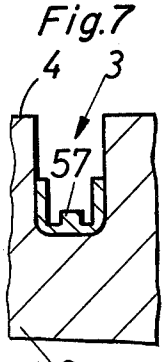


Fig.8

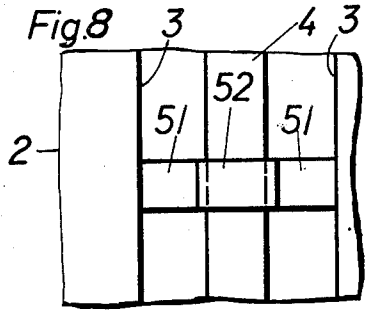


Fig.9

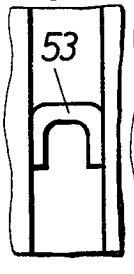


Fig.10

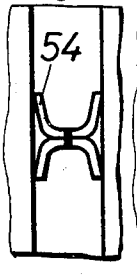


Fig.11

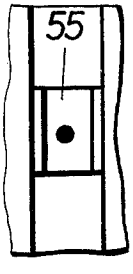


Fig.12

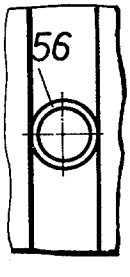
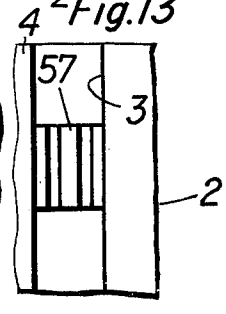


Fig.13



STEAM HEATED DRYER CYLINDER

The present invention relates to a steam heated dryer cylinder and, in particular, to a dryer cylinder provided internally with circumferential grooves from which condensate is withdrawn by suction pipes.

Dryer cylinders are known, and a well known use for such dryer cylinders is the use thereof as creping cylinders for machines of the type which produce wadding and the like. In respect of such dryer cylinders, uniform heat transmission therethrough to maintain a substantially uniform temperature on the outer surface is highly important. Cool spots on the outer surface of the dryer cylinder, or overheated spots thereon, will lead to the production of a deficient product.

It is known that the provision of such dryer cylinders with internal circumferential grooves substantially improves the uniformity with which heat is transmitted radially outwardly through the wall of the dryer cylinder. Such cylinders are provided with end members which close the inside of the cylinders and from which end members there protrude shafts on which the cylinder is rotatably supported. Steam is introduced into the inside of the cylinder through at least one of the shafts and condensate resulting from the steam is withdrawn from the aforementioned annular grooves.

While the improvement of internally grooving the dryer cylinders led to a more uniform heat distribution on the outer surface of the dryer cylinder, the defect existed that the condensate film in the regions of the ends of the suction pipes through which the condensate is withdrawn, was thinner than elsewhere and the heat transmission rate through the wall of the dryer cylinder was, accordingly, substantially higher in the region of the ends of the suction pipes.

With the foregoing in mind, a primary objective of the present invention is the provision of an internally grooved steam heated dryer cylinder in which the outer surface of the cylinder is substantially uniform over the entire area thereof.

Another object of the invention is the provision of an internally grooved steam heated dryer cylinder in which the condensate is withdrawn from the grooves in the cylinder while the flow of condensate in the grooves in the cylinder is so modified as to produce substantially uniform temperature conditions over the entire outer surface of the dryer cylinder.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, a dryer cylinder is constructed consisting of a hollow tubular outer part closed by end members and which end members have supporting shafts thereon for rotatably supporting of the dryer cylinder. The interior of the cylinder is provided with a plurality of axially distributed annular grooves.

The dryer cylinder is heated by introducing steam into the inside of the cylinder and the condensate from the steam collects in the annular grooves. Suction pipes extend into the annular grooves and withdraw the condensate from the interior of the cylinder.

According to the present invention, the grooves are provided with circumferentially spaced dam-like inserts which engage the side walls and bottoms of the respective grooves so that the condensate film in each groove, in flowing about the groove to the respective suction pipe, or pipes, is subjected to intensive turbulence.

The turbulence established in the film of condensate in each groove promotes an even transmission of heat to the outer surface of the cylindrical shell of the dryer cylinder. Because such cylinders are quite large and have a great many grooves therein, the aforementioned inserts are pressed in position whereby an economical manner is provided for providing a dryer cylinder with the several thousands of inserts required therefor.

The radial heighth of the inserts above the bottom wall of the respective groove may vary from about 2 millimeters to about 15 millimeters. The inserts are, thus, of about the same order of magnitude in heighth as the thickness of the condensate film in the respective groove and this will insure the establishing of conditions of optimum turbulence in the condensate film.

It has been found that it is advantageous to arrange the inserts in each groove at a circumferential distance of about 0.1 meters to about 0.5 meters from each other. This spacing has been found to establish a favorable degree of turbulence in the condensate film which collects in each groove and which flows thereabout to one or more points of the suction by means of which the condensate is withdrawn from the cylinder.

The objects referred to above as well as still other objects and advantages of the present invention will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings in which:

FIG. 1 is a somewhat schematic transverse cross section through a dryer cylinder in the plane of an internal circumferential groove thereof and showing the provision of the dam-like inserts in the groove.

FIGS. 2 to 7 are fragmentary longitudinal cross sections through a dryer cylinder and illustrating a plurality of different types of dam-like inserts disposed in the respective grooves.

FIGS. 8 to 13 are plan views looking down on top of FIGS. 2 to 7 respectively and showing more in detail the construction of the different types of inserts that can be disposed in the grooves.

DESCRIPTION OF THE INVENTION

Referring to the drawings somewhat more in detail, reference numeral 1 designates generally a dryer cylinder and which comprises a cylindrical shell 2. The shell 2 is provided internally with a plurality of axially distributed circumferential grooves 3. The grooves 3 define therebetween the annular ribs 4.

Disposed in the grooves 3 in circumferentially distributed relation are the dam-like inserts 5. Each insert is in substantial contact with the bottom of the respective groove and is clamped in place in the respective groove by an elastic spring action which is inherent in the insert.

FIGS. 2 to 7 and 8 to 13 illustrate various forms which the inserts 5 can take. Commencing with FIGS. 2 and 8, in the two grooves shown, dam-like inserts 51 are provided which are integrally connected by a U-shaped bow portion 52. Bow portion 52 is pushed over the rib 4 between the adjacent grooves and clamps against the rib and thereby holds the inserts 51 in place in the grooves. It will be noted that each insert 51 extends from side to side of the respective groove and also substantially engages the bottom wall of the groove and thereby provides a damming action which will in-

duce turbulence in the condensate film flowing in the respective groove.

In FIGS. 3 and 9, there is shown a U-shaped insert 53 which has a radial longitudinal axis and which is pressed into the respective groove so that the side legs of the U-shaped insert bear against the ribs on opposite sides of the respective groove while the end leg of the insert extends transversely of the groove thereby damming the groove in the described manner.

In FIGS. 4 and 10, the insert 54 is formed of two U-shaped sections having the end legs welded together, as by spot welding, while the side legs extend in the circumferential direction of the respective groove and resiliently bear against the ribs between which the respective groove is confined.

In FIGS. 5 and 11, the insert 55 is formed of a U-shaped member with the side legs extending radially outwardly of the respective groove and with a filler member secured between the side legs of the insert and thereby providing the damming action for the respective groove which has been referred to above.

FIGS. 6 and 12, the insert is in the form of a short piece of pipe which is pressed into the groove with the longitudinal axis of the piece of pipe radial thereby establishing the damming action referred to in an extremely simple manner.

Finally, in FIGS. 7 and 13 the insert 57, and which is similar to the aforementioned insert 55, is U-shaped in cross section having a bottom leg resting on the bottom of the respective groove and side legs extending radially at the sides of the groove and with an integral member upstanding between the side legs thereby providing the damming or flow inhibiting and turbulence creating effect which has been described above.

In the normal course of events, one type of insert only would be employed in a given dryer cylinder, and FIGS. 2 to 7 and 8 to 13 merely show that a plurality of different types of inserts could be provided which would produce the same turbulent action in the condensate film in the grooves.

As has been mentioned, the radial heighth of the inserts measured from the bottoms of the respective grooves can vary from about 2 millimeters to about 15 millimeters, and it is advantageously somewhat near the normal heighth of the condensate film in the groove.

It has been found that the inserts can be circumferentially spaced a distance of from about 0.1 meters to about 0.5 meters about the respective grooves and this spacing has, in practice, proved to be quite favorable for establishing the desired conditions of turbulence in the condensate film flowing about the grooves.

In respect of the suction pipes which withdraw condensate from the annular grooves, these pipes are conventionally fixed to the cylinder structure to rotate therewith and, thus, withdraw condensate from a groove at one or two points and which points may be diametrically opposed as indicated in FIG. 1. The condensate which forms within the cylinder and which will be thrown out into the annular grooves by centrifugal action due to the rotation of the dryer cylinder will, thus, flow along the grooves to the point, or points, in the groove where suction is applied for withdrawing the condensate from the grooves.

Modifications may be made within the scope of the appended claims.

What is claimed is:

1. That method of providing for substantially uniform temperature over the entire outer circumferential surface of an internally steam heated dryer cylinder having axially distributed internal circumferential groove means in which condensate collects and from which the condensate is withdrawn from at least one point fixed in the circumferential direction of the groove means, said method comprising inserting dam-like flow obstructing elements in circumferentially spaced relation in said groove means with each said element upstanding from the bottom wall of the groove means, said elements creating turbulent flow conditions in the condensate which collects in the groove means as the condensate flows in the groove means toward the point of withdrawal thereof from the groove means.

2. In a steam heated dryer cylinder having a cylindrical outer shell; axially distributed circumferential grooves and intervening ribs formed on the inside of the shell and in which grooves condensate collects, means for withdrawing condensate from the said grooves at at least one peripheral region thereof fixed relative to the cylinder circumferentially and dam-like inserts disposed in circumferentially distributed relation in at least some of the grooves and dividing the respective grooves into circumferential regions, each insert extending from side to side of the respective groove and extending from the bottom of the respective groove a predetermined distance upwardly therein and operable to obstruct circumferential flow of condensate in that region of the respective groove which is adjacent the bottom of the groove, each said insert being press fitted into the respective groove.

3. A dryer cylinder according to claim 2 in which said inserts are spaced apart circumferentially in said grooves a distance of about 0.1 meters to about 0.5 meters.

4. A dryer cylinder according to claim 2 in which said predetermined distance which the inserts upstand from the bottom of the grooves is from about 2.0 millimeters to about 15.0 millimeters.

5. A dryer cylinder according to claim 2 in which each said insert is resilient in the lateral direction of the respective groove and in uncompressed state is wider than the side walls of the respective groove.

6. A dryer cylinder according to claim 2 which includes a resilient connecting element connected to a said insert in each of an adjacent pair of said grooves, said connector bridging over the rib between said pair of grooves and clampingly engaging the said rib.

7. A dryer cylinder according to claim 2 in which said inserts include a U-shaped element having side legs extending circumferentially of the cylinder and engaging the side walls of a groove and an end leg extending radially of the cylinder and engaging the bottom wall of the groove.

8. A dryer cylinder according to claim 2 in which said inserts include a pair of U-shaped elements having the end legs fixed together and engaging the bottom wall of a groove and having the side legs extending away from the fixed together end legs and engaging the side walls of the groove.

9. A dryer cylinder according to claim 2 in which said inserts include a U-shaped member having an end leg engaging the bottom wall of a groove and side legs extending upwardly along the side walls of the groove, and a filler member extending between said side legs and resting on said bottom leg.

10. A dryer cylinder according to claim 2 in which said inserts include a U-shaped member having an end leg engaging the bottom wall of a groove and side legs extending upwardly along the side walls of the groove, and a filler member integral with said bottom leg and upstanding from the bottom leg in the space between said side legs.

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