July 18, 1967 F. N. LOCKHART 3,331,434

HEAT TRANSFER ROLL

Filed June 29, 1965 2 Sheets-Sheet 1

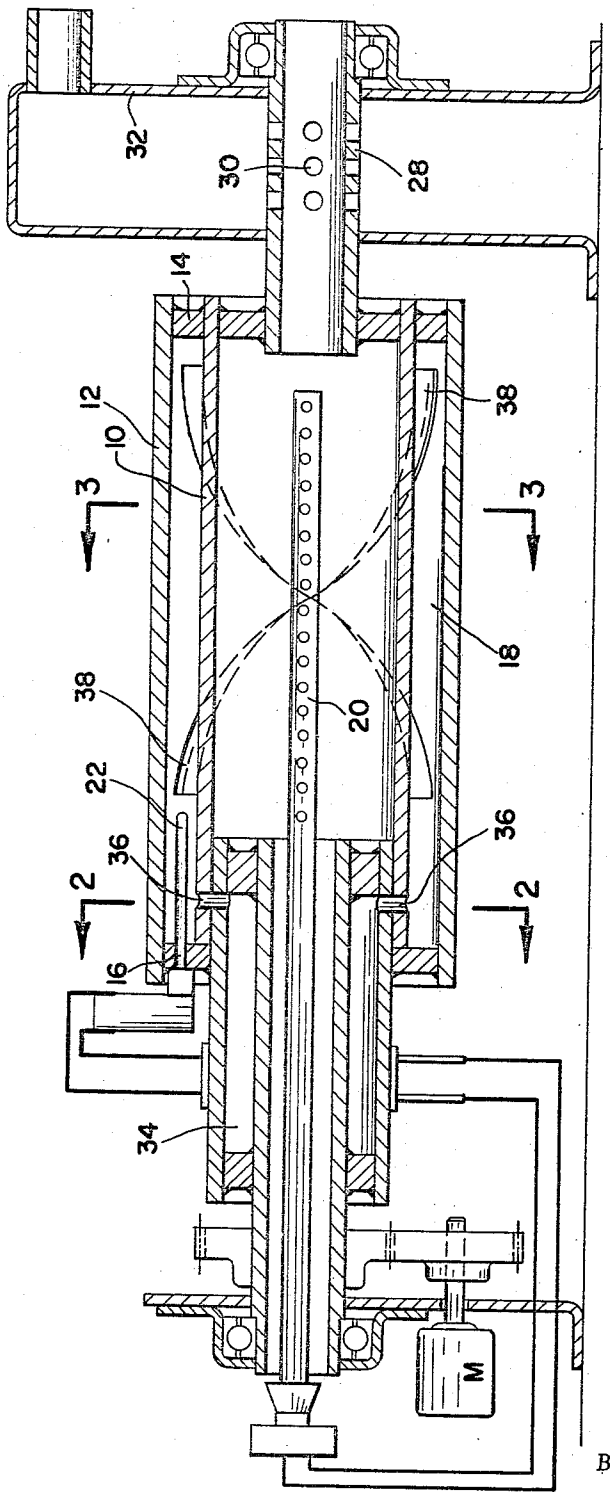


FIG. 1

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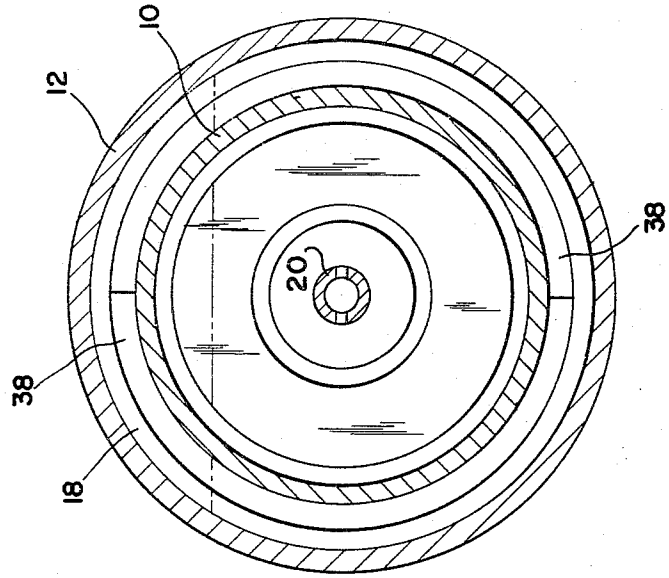


FIG. -3-

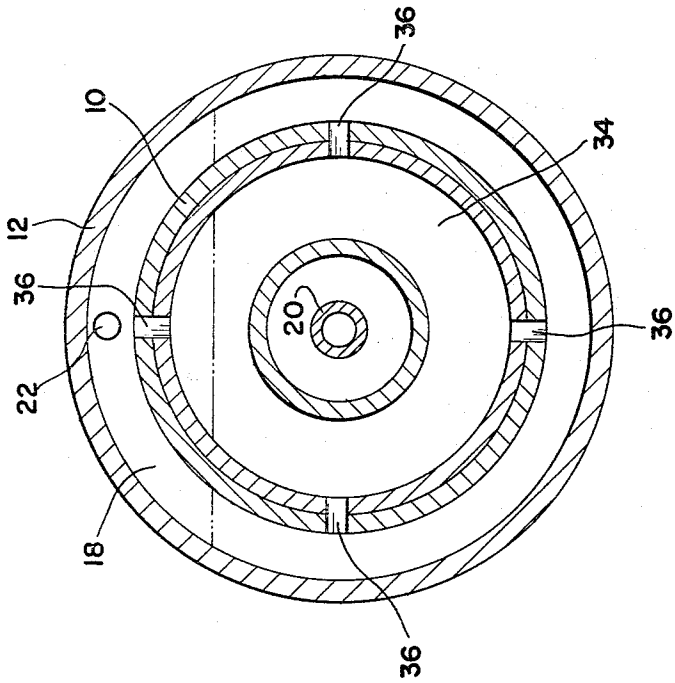


FIG. -2-

INVENTOR.

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United States Patent Office 3,331,434 Patented July 18, 1967

3,331,434

HEAT TRANSFER ROLL

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5 Claims. (Cl. 165—89)

My invention relates to a machine of the type set forth in Roberts Patent No. 2,488,937.

One object of the invention is to produce an improved machine of the type set forth which, however, is not limited to the specific uses stated in said patent.

Machines embodying the disclosure of the Roberts patent have been sold in fairly large numbers and have operated successfully. But because it was necessary to limit the liquid content of the jacket to less than full capacity, the thermal control probe, which regulates the operation of the burner (which is not shown in said patent), was bared with every revolution and produced fluctuations in the heat in-put which correspondingly affected the temperature of the liquid in the jacket. This fluctuation is serious in any event but is more serious when the rolls are turned at low speed.

It is therefore a further object of the invention to produce an improved machine wherein the thermal control probe is fully submerged at all times and at all speeds.

Also, in the patent aforesaid, the burner was located near one end of the roll and internal vanes were relied on to circulate the liquid to achieve such uniformity of temperature as was possible within the limitations inherent in that type of apparatus.

It is therefore the object of the invention to produce an improved machine of the type set forth in which the burner heat in-put is distributed more evenly over the entire length of the jacket.

Modern industry requires high speed operation and when the apparatus of the patent aforesaid was run at high speed, an unaccounted for differential in the temperature of the opposite ends of the roll was observed. Various studies and experiments were undertaken without any results.

While these investigations were going on, applicant received a complaint that a machine installed in Tasmania, also showed a similar, but oppositely oriented temperature differential. This prompted further investigations which showed that the machine in Tasmania was identical with machines in the latitudes north of Mexico and that the roll was rotated in the same direction. Further cogitation suggested that the Coriolis effect (which causes a liquid to move in one direction inside a clockwise rotating roll located south of the equator but causes liquid to move in the opposite direction in a clockwise rotated roll located north of the equator) could be responsible for the equal but oppositely oriented differential.

It is therefore a still further object of the invention to produce an improved machine of the type set forth which is not subject to the Coriolis effect.

The full nature of the invention will be understood from the following specification and the accompanying drawing in which:

FIG. 1 is a sectional view of a roll type heat setting machine embodying the invention.

FIG. 2 is an enlarged sectional view looking in the direction of line 2—2 on FIG. 1.

FIG. 3 is an enlarged sectional view looking in the direction of line 3—3 on FIG. 1.

The machine illustrated is, in the main, like that shown in the patent aforesaid in that it comprises an inner cylinder **10** and an outer cylinder **12** and end walls **14** and **16** which cooperate to define a space **18** for receiving a

heat transfer agent having a high boiling point such as "dowtherm" or other satisfactory available liquid.

Within inner cylinder **10**, and entering through end wall **16** is a line burner **20** which is supplied with fuel from a suitable source, not shown, but subject to control of thermal probe **22** which, as will be explained below, is constantly submersed in the liquid in space **18** and which regulates the flow of fuel to the burner. The circuitry **26** of control probe **22** is conventional and need not be described. It is sufficient to say that a fall in the temperature of the liquid in jacket **18** causes probe **22** to increase the flow of fuel and vice versa.

Entering the combustion chamber and passing through end wall **14** is an exhaust pipe **28** which has ports **30** which lead to discharge pipe **32**.

In order to allow for expansion and evaporation, a closed jacket **18** can only be filled up to the level of the broken line in FIG. 2 and as stated, this limitation is responsible for the difficulties enumerated above.

According to my invention I am able to fill jacket **18** completely and still provide room for expansion.

This is accomplished by providing a reservoir **34** which communicates with jacket **18** through ports **36** which permit movement of liquid between jacket **18** and reservoir **34**. It will be understood that reservoir **34** is rigidly secured to, for joint rotation with cylinders **10** and **12** by motor M and suitable gearing which need not be described. It should be noted that the capacity of reservoir **34** is such that it can contain liquid enough, or slightly more than enough, completely to fill jacket **18**.

The operation is as follows:

When the machine is at rest, some of the fluid in jacket **18** will flow into reservoir **34** and the level of the liquid will be at about the broken line in FIG. 2. When the roll is rotated, centrifugal force throws the liquid in reservoir **34** outwardly through ports **36** and into jacket **18** until the latter, is full. The residual liquid adheres to the inside wall of reservoir **34** and leaves the central portion thereof empty and ready to receive evaporation, if any, and to relieve the liquid pressure which may result from expansion of the liquid in jacket **18**. By this arrangement, jacket **18** will be completely filled when the machine is in operation and control probe **22** will at all times be fully submerged, thus providing better and constant control of the heat in-put. The fact that the jacket is completely filled counteracts the Coriolis effect and makes for more uniform heat transfer.

If desired, vanes **38**, like those shown in the patent aforesaid, may be added further to improve the circulation of the fluid in jacket **18**.

What I claim is:

1. A heat transfer roll including:
means defining a jacket adapted to receive a fluid transfer medium,
a reservoir adapted to receive a fluid medium and communicating with said jacket,
means securing said reservoir to said roll,
and means for jointly rotating said roll and said reservoir whereby centrifugal force drives fluid from said reservoir into said jacket during rotation thereof,
said reservoir being so related to said jacket that, in the absence of centrifugal force, liquid flows from said jacket into the reservoir.

2. The structure defined in claim **1** in which said reservoir is adjacent one end of the roll.

3. The structure recited in claim **1** in which said reservoir and said jacket are concentric and in which the diameter of the reservoir is not greater than the smaller diameter of said jacket.

4. The structure recited in claim **1** in which said reservoir and said jacket have a common axis of rotation

and in which the reservoir is nearer the axis of rotation than the jacket.

5. A heat transfer roll including:

means defining a jacket having a predetermined volumetric capacity and containing fluid less than said capacity whereby a fluid free gap is formed in said jacket,

a heater for said jacket,

a reservoir communicating with said jacket and containing fluid in an amount at least sufficient to fill said gap,

and means for jointly rotating said roll and said reservoir to transfer fluid from said reservoir to said jacket by centrifugal force.

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