June 2, 1970 H. G. VORE ET AL 3,515,281

BACKING WIRE FOR ROTARY DRUM FILTERS

Filed May 9, 1968 2 Sheets-Sheet 1

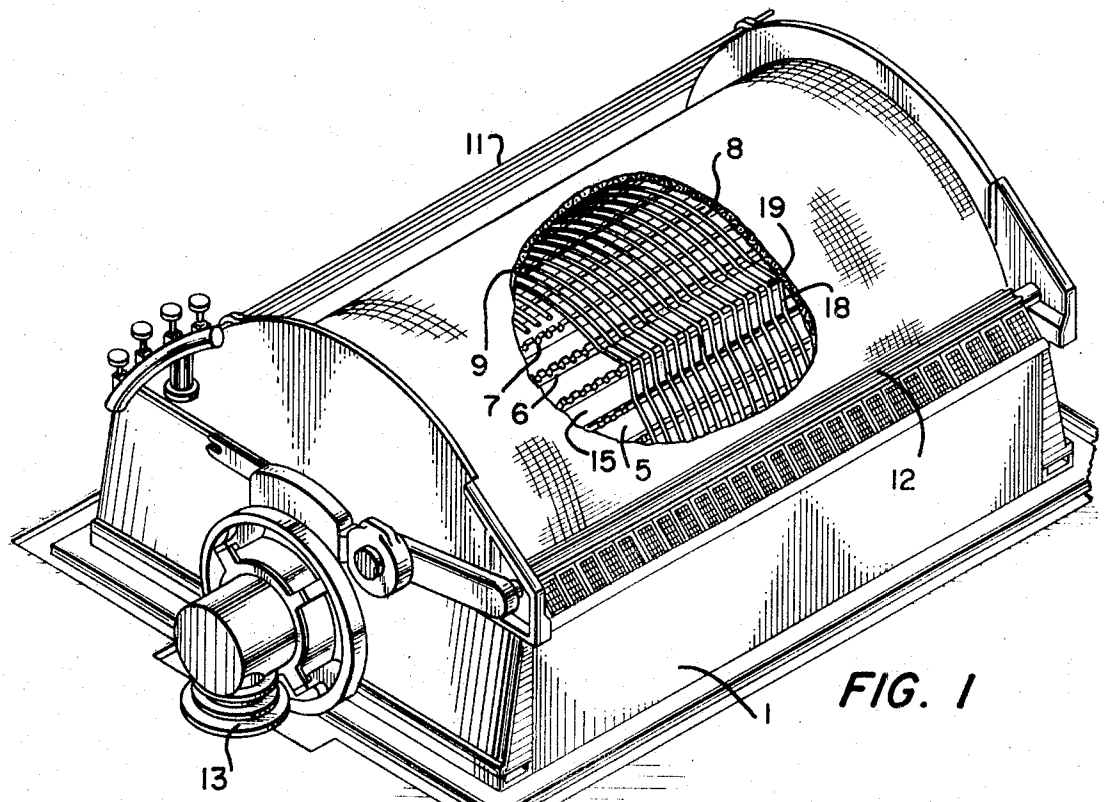


FIG. 1

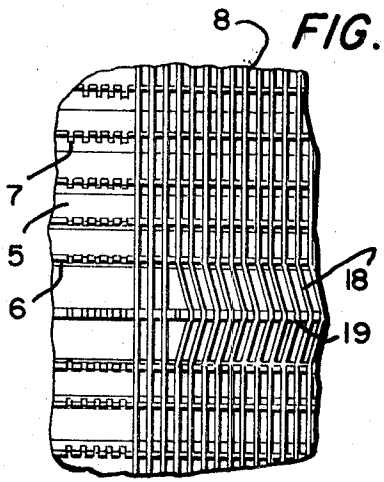


FIG. 2

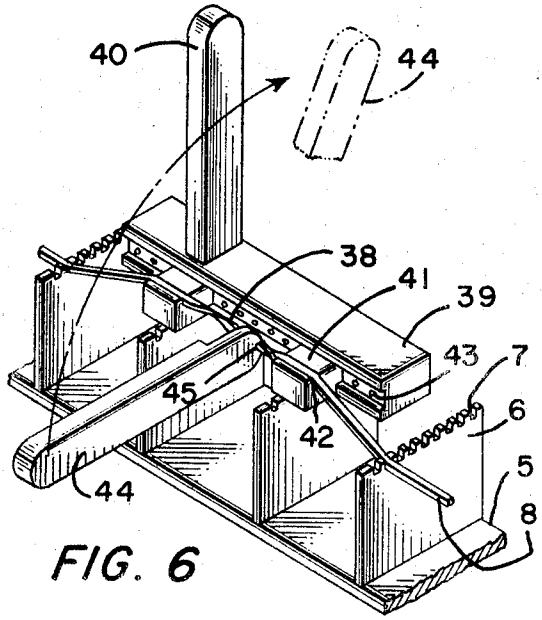


FIG. 6

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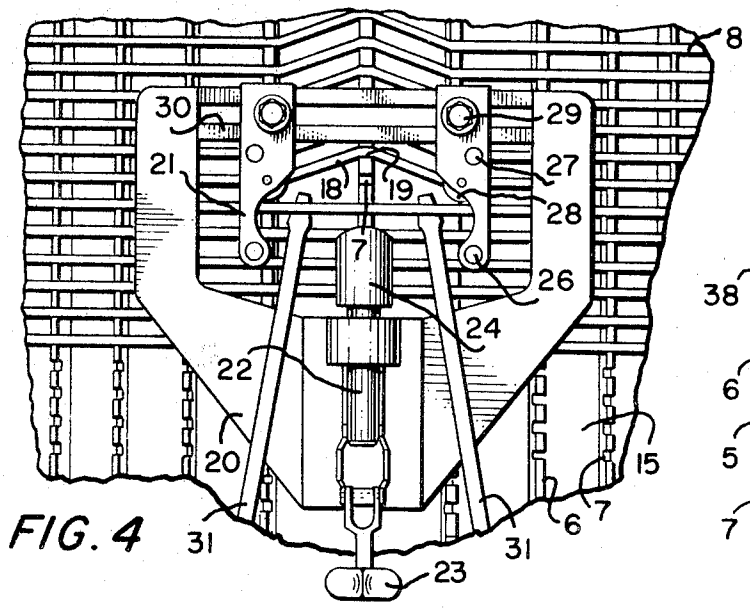


FIG. 4

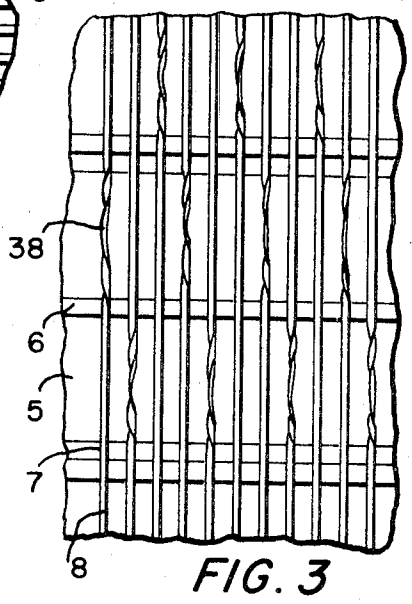


FIG. 3

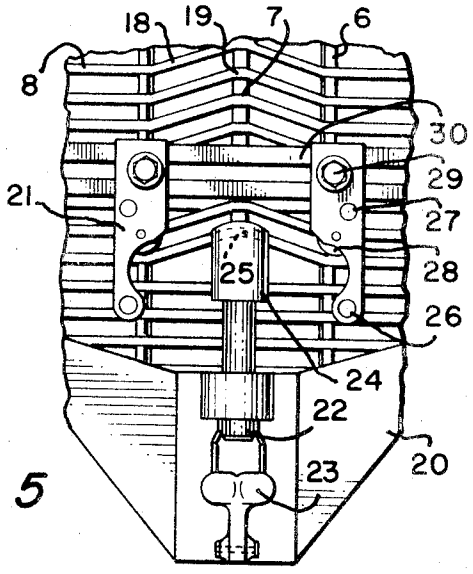


FIG. 5

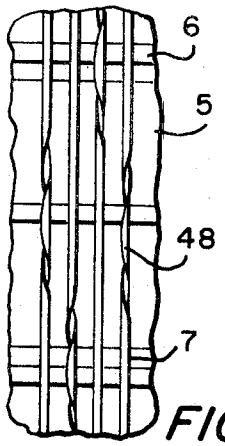


FIG. 7

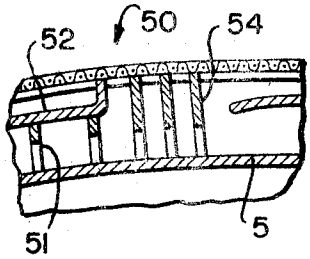


FIG. 8

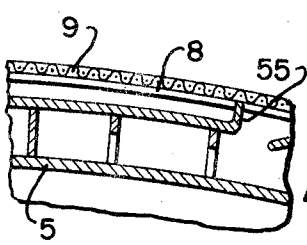


FIG. 9

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BACKING WIRE FOR ROTARY DRUM FILTERS

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Int. Cl. B01d *39/10*
U.S. Cl. 210—402 7 Claims

ABSTRACT OF THE DISCLOSURE

A rotary drum filter including a drum having a plurality of parallel, outwardly extending ribs each having a plurality of notches therein. A filter screen supporting wire is helically wound around the drum within the notches. The supporting wire is formed to cooperate with the notches to thereby limit the movement of the wire of the drum due to stresses developed in the wire by variations in temperature. This may be accomplished by forming a V in the wire or by twisting the wire. Apparatus is provided for forming the wire.

BACKGROUND OF THE INVENTION

This invention relates to rotary drum filters and more particularly to means for preventing the backing wire of a rotary drum filter from moving and stretching and accumulating at one end of the filter or backing wire section.

Rotary drum filters as used in the paper and pulp industry include a drum which rotates in a bath of material to be filtered. The drum normally includes a cylindrical base having a plurality of parallel, outwardly projecting ribs extending along the length of the drum which form filtrate flow guide means. Each support rib has a plurality of spaced apart notches. A continuous wire is helically wound around the drum within the notches. A single wire may be wound around the entire drum, but it is usually preferable to wind the wire in approximately two-foot sections measured along the length of the drum. A separate wire is used for each section. This wire is used to support a filtering element such as a screen. As the drum rotates in the bath, liquid is filtered through the screen into the channels formed by the ribs. The solid material or "cake" which is formed on the screen is then taken off by suitable rollers or other take-off devices well known in the art.

The wire is subjected to differences in temperature when the drum is rotated in the bath due to temperature differences between the vat, showers, take-off rolls and the like. These temperature differences set up stresses in the wire causing the wire to stretch and move relative to the drum. The excess wire which results from the temperature differences tends to accumulate at one end of the wire section or, if a single wire is wound around the entire drum, at the end of the drum. This excess wire damages the filter screen, take-off rolls and other parts of the machine eventually causing failure of the machine.

Prior to this invention, attempts to solve the problem of wire accumulation included placing the wire under high tension as it was wound around the drum. With modern machines which are used in more severe conditions, the increased tension on the wire was found to be inadequate to overcome the problem. Another method of overcoming the problem is shown in U.S. Patent No. 2,300,166, issued to J. B. Nowak. In that patent, a turn buckle is used to take up the slack in the wire as it stretches. Such an arrangement does not, however, prevent the stretching which, by the time it is discovered, can damage the machine. In addition, the slack which can be taken up by the turn buckle is inherently limited.

Although the problem can be substantially reduced by

the use of individual wire sections which cover only a portion of the circumference of the drum, such as those shown in U.S. Patent No. 2,472,558, the manufacturing advantages of a continuous wire are lost. In addition, the individual sections can stretch and cause damage to the machine.

SUMMARY

It is therefore the principal object of this invention to provide an arrangement which prevents the backing wire of a rotary drum filter from moving relative to the drum and accumulating at the end of the drum or wire section.

It is a further object of this invention to provide an arrangement which prevents accumulation of the filter screen backing wire at the end of the wire sections of a rotary drum filter but does not require alterations in the basic apparatus or method of manufacture.

In general, these and other objects are carried out by providing a rotary drum filter comprising: a drum, a plurality of parallel, outwardly projecting ribs mounted on the outer periphery of said drum, each having a plurality of spaced apart notches in its outer edge; a wire helically wound around said drum within said notches; said wire having at least one portion formed to cooperate with at least one of said notches for retaining said wire tightly wound around said drum; and filter means surrounding the outside of said drum and supported by said wire.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention will be described in connection with the annexed drawings wherein:

FIG. 1 is a perspective view of a rotary drum filter embodying the present invention;

FIG. 2 is a fragmentary view of a portion of a drum showing a first embodiment of this invention partially applied to the drum;

FIG. 3 is a fragmentary view of a portion of a drum showing a second embodiment of this invention;

FIG. 4 is a plan view of apparatus for forming the backing wire in accordance with the first embodiment of this invention;

FIG. 5 is a fragmentary view of a portion of FIG. 4 with the apparatus in an advanced stage of forming the wire;

FIG. 6 is a perspective view of apparatus for forming the backing wire in accordance with the second embodiment of this invention;

FIG. 7 is a fragmentary view of a portion of a drum showing a modification of the second embodiment of this invention; and

FIGS. 8 and 9 are fragmentary views of portions of a different type of filter.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a substantially conventional rotary drum filter as used in the paper and pulp industry. Numeral **1** designates a bath which may be any conventional arrangement used to contain material to be filtered. The drum **5** is rotatably mounted in the path **1**. A plurality of parallel, outwardly projecting ribs **6** are mounted on the drum so that they are parallel to the longitudinal axis of the drum. Each of the ribs **6** is provided with a plurality of notches **7** throughout its entire length. A beaking wire **8** is helically wound around the drum within the notches **8**. The wire **8** may be a continuous piece extending the entire lenght of the drum but, preferably, the drum is wound in sections so that if a wire fails, only that section in which the failure occurs need be replaced. A conventional filter screen **9** covers the drum and is supported by the backing wire **8**.

The drum is rotated in the bath by a suitable motor

means (not shown). As is more fully explained in U.S. Pat. No. 3,363,774, during rotation of the drum, a vacuum is selectively applied to channels **15** formed by the ribs **6** during portions of the rotary path of the drum. The vacuum draws liquid through the filter screen **9** and a "cake" is formed on the screen. Conventional showers **11** are provided and a "cake" take-off roll **12** removes the filtered material from the filter screen **9**. An outlet **13** allows the filtrate to be removed from the channels **15**. The operation of the filter and the apparatus for applying a vacuum to the channels **15** are conventional and form no part of this invention.

The temperatures encountered during operation of the filter are different from the temperatures encountered during the winding of the wire around the drum and there are temperature variations during the various phases of the operation of the filter. The differing temperatures cause the wire **8** to stretch and "move" through the notches **7** and accumulate at one end of the wire section. Such accumulation damages the screen **9** and take-off roll **12** eventually causing failure of the machine.

In order to substantially reduce this movement, the wire **8** is formed to cooperate with the notches **7** to thereby retain the wire tightly wound around the drum. In the embodiment of FIGS. 1 and 2 this function is carried out by forming a V or "zig zag" in each wind of the wire **8**. In FIG. 3 this function is carried out by twisting the wire between adjacent ribs or, as shown in FIG. 7, by twisting the wire at least 180° and placing the center of the twist in a notch.

Referring to FIGS. 1 and 2 a V shape **18** (FIG. 2) is formed in each turn of the wire around the drum. This is done by removing the wire **8** from a notch **7** and placing it in a next higher notch **7**. In carrying out the embodiment of FIGS. 1 and 2, the wire is wound completely around the drum in the usual manner. The first notch **7** at the end of one rib **6** is either widened so that it may accommodate two wires or an additional notch is provided. One portion of the second turn of the wire is then moved to the widened notch to form a V in the turn of the wire. The apex **19** of the V is positioned in the notch, and the legs of the V terminate in a notch in the adjacent ribs. A portion of the third turn of the wire is then moved to the second notch to thereby form a V in that turn. At one point in each turn of the wire, the wire is displaced one notch until each turn of the wire has a V shape in it. This sequence is generally shown in FIG. 2.

In order to form the V-lock, a suitable tool shown in FIGS. 4 and 5 has been provided. This tool includes a frame **20** on which is mounted a support **21**. A toggle arrangement **22** having a handle **23** and bunter **24** which may have a groove **25** therein are also mounted on the frame **20**. The supports **21** carry a pair of stops **26** and **27** and cam follower rolls **28**. In use, levers **31** are used to lift a portion of the wire **8** out of its normal notch **7**. The toggle is moved forward or upward so that the wire **8** is positioned in the groove **25** in the bunter **24**. Continued forward movement of the toggle arrangement forms with the cam rollers a suitable V **18** in the wire **8**. The apex **19** of the V is then fit within a notch **7** which is aligned with the notches of the next wire turn while the legs extend down to the adjacent ribs as clearly shown in FIGS. 2 and 5. The V forming tool is suitable for all sizes of filters in that it is adjustable by means of an adjusting slide **30** and adjusting bolts **29**. As the size of the grid spacing is increased, the supports **21** may be moved apart. The stops **26** and **27** assure accurate alignment.

The spacing between the ribs **6** and the distance between the notches **7** determine the holding power of the lock. As the spacing between the ribs **6** is decreased and the distance between the notches is increased, the holding power of the lock will be increased. The amount of holding power required is determined by the size and use of the filtering apparatus. On one unit having a one-inch spacing between ribs using a ⅜ inch spaced D-shaped wire at 45,000 p.s.i. tension, the V-lock provided a holding power of 900 pounds against differential stresses. Each holding power was not heertofore obtainable by merely increasing the tension on the ends of the wire. If greater holding power is desired, more than one V-lock may be used in each turn of the wire.

A second embodiment of this invention is shown in FIG. 3. In this embodiment rather than forming a V-lock in each turn of the wire, the area between two adjacent ribs **6** is twisted as at **38** about its own axis. The twist not only tends to shorten the wire thereby increasing tension, but also prevents movement of the wire in the notches. Since the wire is twisted, it cannot move through a notch **7**. Each twist is preferably at least 90° but may be more. The twist for each turn of the wire around the drum is preferably staggered from the twists of the adjacent turns. If greater holding power is desired, more than one twist may be placed in each turn.

A modification of the twist lock is shown in FIG. 7. In this modification, a twist **48** of 180° or a multiple thereof is formed in the wire and the center of the twist is placed in a notch **7**. This modification is particularly useful on filters where there is wide spacing between ribs.

In order to form the twists in the wire **8**, a suitable tool shown in FIG. 6 has been provided. This tool includes a jig plate **39** having a handle **40** attached thereto. A pair of wire supports **41** extend outwardly from the jig plate **39**, each having a groove **42** therein to support the wire **8**. The wire supports **41** are connected to the plate **39** through adjusting holes **43**. In order to apply the twist to the wire **8**, a handle **44** having a groove **45** is provided. The wire **8** is placed in the groove **45** and the handle rotated as shown by the arrow in FIG. 6. To apply a 90° twist to the wire, the handle **44** is rotated once to the position shown by broken lines. If a twist of more than 90° is desired, the turning operation is repeated until the desired angle is achieved. The jig is then removed and the wire **8** replaced in the notch **7** of the rib **6**.

It has been found that the locking means of this invention is particularly well suited for use on center valve louvered filters such as that shown in U.S. Pat. No. 3,306,460 issued to O. Luthi. The application of this invention to such a filter can be seen by referring to FIGS. 8 and 9 wherein filtrate flow guide means is generally designated at **50**. In a louvered filter, the filtrate flow guide means includes supporting members **51** and cover element **52** which has an upwardly turned end **55** which forms a wire supporting rib having notches therein. If the V-lock is to be used, three ribs **54** are added to the flow guide means **50** between adjacent cover elements **52**. Each of these ribs is provided with a plurality of notches and the V-lock is formed at these ribs in the same manner as with the filter shown in FIG. 1. If the twist lock is to be used, it is not necessary to add the additional ribs. With the twist lock, a twist such as that shown in FIG. 7 may be formed in the wire and the center of the twist may be placed in a notch in the upturned end or rib **55**. The twist on opposite sides of the rib prevent movement of the wire through the notch.

In both the V-lock and the twist lock, the cooperation between the formed wire and the notches **7** and ribs **6** holds the wire tightly against the ribs **6** within the notches **7**. The stretching due to the increases in temperatures is limited to a single turn of the wire around the drum **5**. The twist or V-lock retains the wire tightly wound around the drum within the notches and prevents the wire from accumulating at one end of a wire section or the drum. Longer life of the screen **9** and filter apparatus as a whole is thereby provided.

From the foregoing it is apparent that the objects of this invention have been carried out.

We claim:

1. A rotary drum filter comprising:

a drum;

a plurality of parallel, outwardly projecting ribs mounted on the outer periphery of said drum, each having a plurality of spaced apart notches in its outer edge;

a wire helically wound around said drum within said notches to thereby form a plurality of turns;

means cooperating with said notches for anchoring said wire within said notches at a plurality of locations between the ends of said drum for retaining said wire tightly wound around said drum; and

filter means surrounding the outside of said drum and supported by said wire;

in a plurality of turns of said wire around said drum, said wire being twisted between two adjacent ribs to cooperate with said notches to form said means for anchoring said wire within said notches.

2. The rotary drum filter of claim 1 wherein the twists for successive turns of said wire are staggered.

3. A filtering apparatus comprising:

a drum;

filtrate flow guide means mounted on the outer periphery of said drum and including a plurality of outwardly projecting ribs each having a plurality of notches in its outer edge;

a wire substantially continuously helically wound around said drum within said notches to form a plurality of turns;

means positioned at a plurality of locations between the ends of said drum for anchoring said wire within said notches for retaining said wire tightly wound around said drum; and

filter screen means surrounding said drum and supported by said wire;

each turn of said wire around said drum having at least one portion which is twisted at least 180° and the center of the twist is placed in one of said notches to cooperate with said filtrate flow guide means to form said means for anchoring said wire within said notches.

4. A filtering apparatus comprising:

a drum;

filtrate flow guide means mounted on the outer periphery of said drum and including a plurality of outwardly projecting ribs each having a plurality of notches in its outer edge;

a wire substantially continuously helically wound around said drum within said notches to form a plurality of turns;

means positioned at a plurality of locations between the ends of said drum for anchoring said wire within said notches for retaining said wire tightly wound around said drum; and

filter screen means surrounding said drum and supported by said wire;

each turn of said wire around said drum having a V formed therein and the apex of said V being positioned in one of said notches to cooperate with said filtrate flow guide means to form said means for anchoring said wire within said notches.

5. A rotary drum filter comprising:

a drum;

a plurality of parallel, outwardly projecting ribs mounted on the outer periphery of said drum, each having a plurality of spaced apart notches in its outer edge;

a wire helically wound around said drum within said notches to thereby form a plurality of turns;

means cooperating with said notches for anchoring said wire within said notches at a plurality of locations between the ends of said drum for retaining said wire tightly wound around said drum; and

filter means surrounding the outside of said drum and supported by said wire;

in at least some of said turns of said wire around said drum, said wire being twisted at least 180° about its own axis and the center of the twist is positioned in a notch of one of said ribs to form said means for anchoring said wire within said notches.

6. A rotary drum filter comprising:

a drum;

a plurality of parallel, outwardly projecting ribs mounted on the outer periphery of said drum, each having a plurality of spaced apart notches in its outer edge;

the notches of each rib being substantially parallel to the notches of the adjacent ribs;

a wire helically wound around said drum within said notches to thereby form a plurality of turns;

means cooperating with said notches for anchoring said wire within said notches at a plurality of locations between the ends of said drum for retaining said wire tightly wound around said drum; and

filter means surrounding the outside of said drum and supported by said wire;

at least some of the turns of wire around said drum having a V formed therein and the apex of said V is positioned in one of said notches to form said means for anchoring said wire within said notches.

7. The rotary drum filter of claim 6 wherein the apex of said V is positioned in a notch in a first rib and the legs of said V terminate in a notch in the ribs adjacent said first rib.

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