July 23, 1940. A. G. BLANK 2,209,257

FIN-DRUM DRIER

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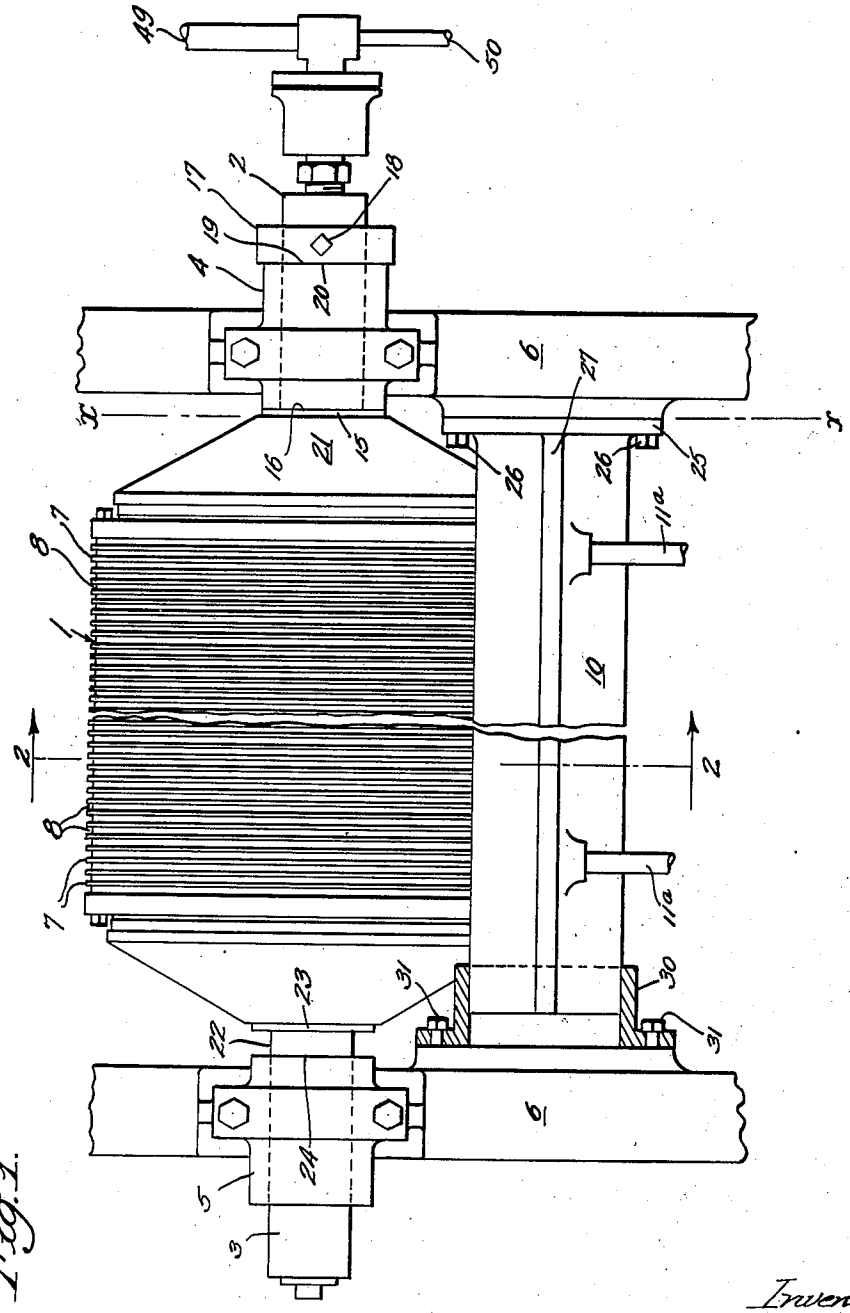


Fig. 1.

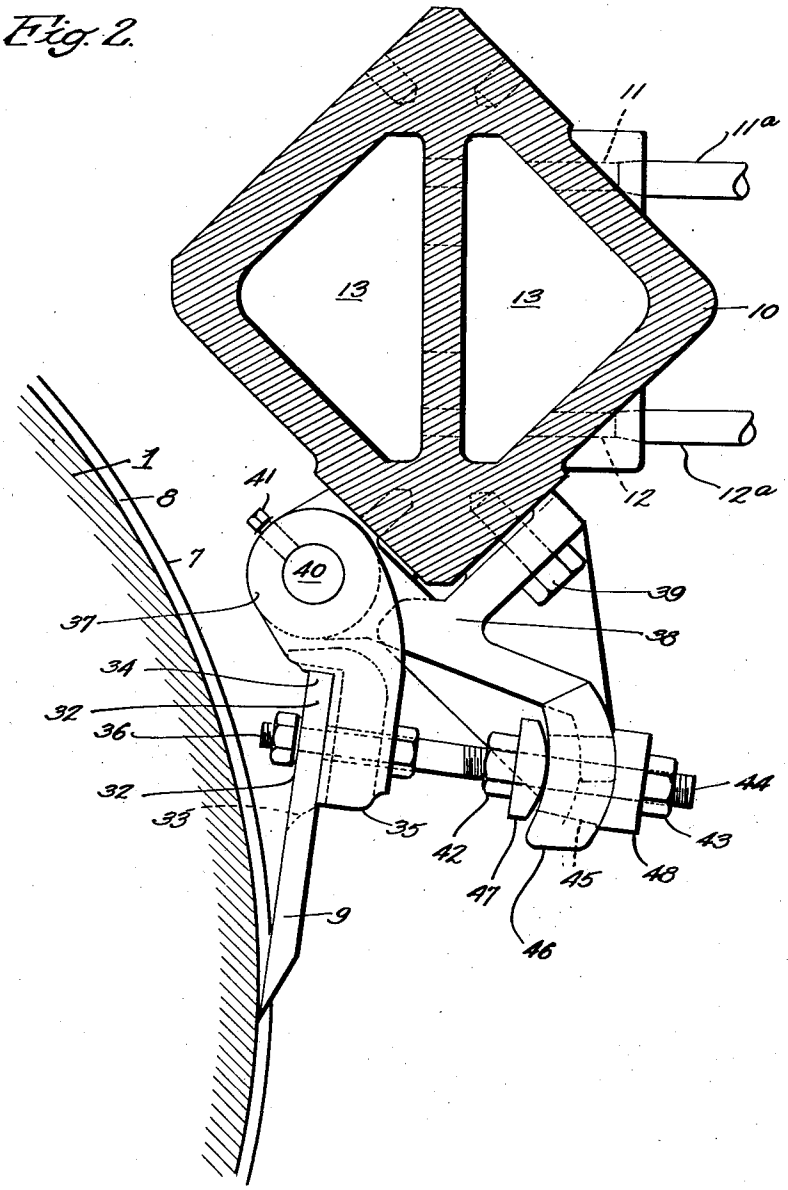
Inventor:
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FIN-DRUM DRIER

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Fig. 2.



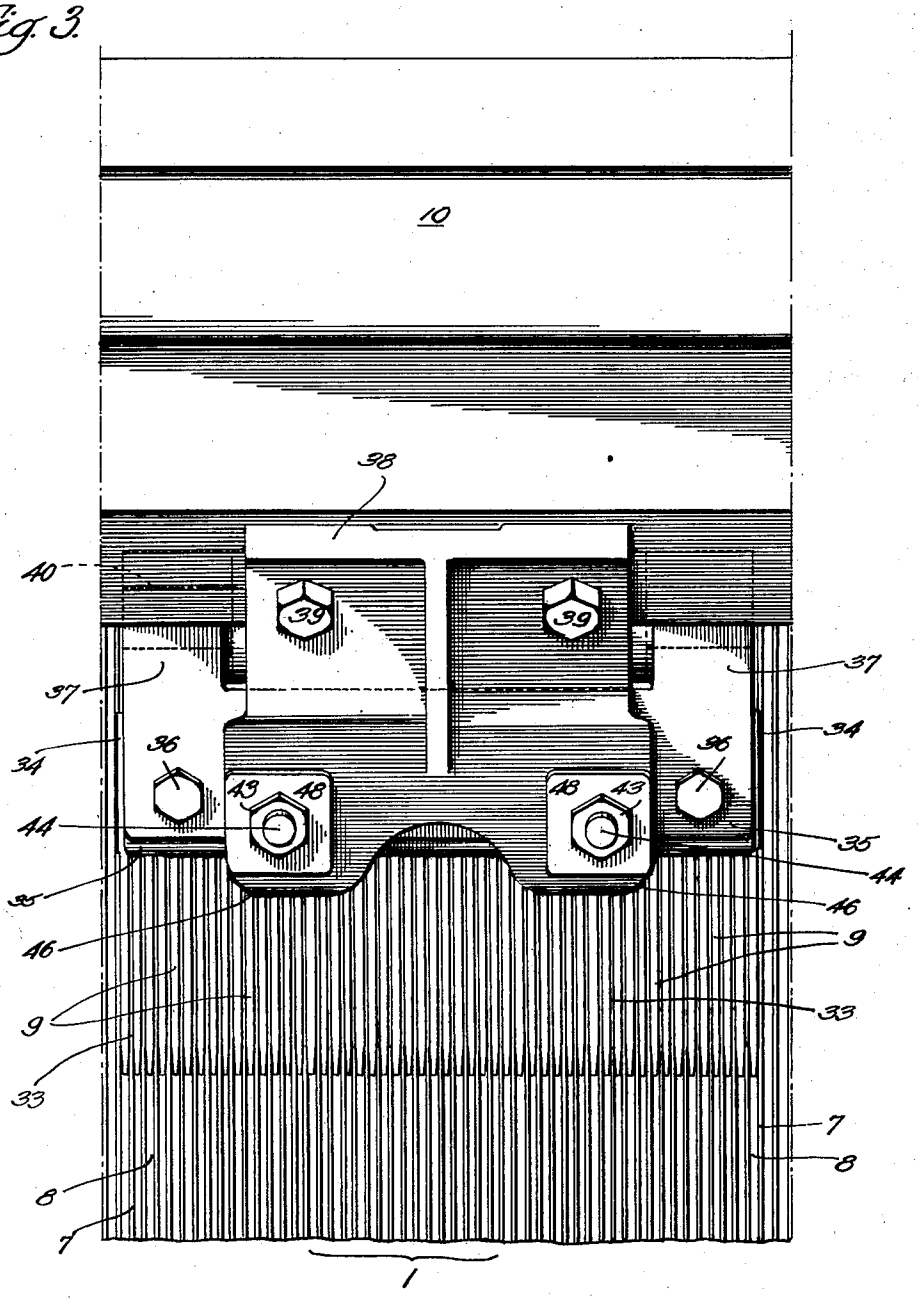
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Fig. 3.



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UNITED STATES PATENT OFFICE

2,209,257

FIN-DRUM DRIER

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Application August 26, 1938, Serial No. 227,001

16 Claims. (Cl. 34—4)

This invention relates to improvements in what is known in the art as a "fin-drum drier." Driers of this type normally include a hollow drum or cylinder which is provided on its outer peripheral surface with a multiplicity of parallel, circumferentially extending ribs or fins. The ribs or fins are spaced apart laterally and form a corresponding series of circumferentially extending grooves in the outer surface of the drum, which receive the material to be dried.

The material to be dried is applied to the drum in either a liquid, semi-plastic or plastic state. Moisture is driven out of the material by heat applied to the drum, usually by steam admitted to the interior of the drum through one or both of the trunnions by which the drum is normally supported for rotation about its longitudinal axis.

The dried material is usually removed from the grooves in the face of the drum by sharply pointed needles or blades operating in the grooves between the circumferential ribs, with the needles or blades pressing against the walls or surfaces of the grooves and ribs and acting as scrapers for cleaning from said surfaces portions of the dried material which tend to adhere thereto.

The scrapers are usually supported en masse by a rigid common carrier which normally extends substantially parallel to the axis of the drum, in spaced relation to the peripheral surface of the drum.

Different kinds of materials require different drying temperatures. It is, therefore, necessary to heat the drum to the temperature required for the particular material being treated. As a result of the heating of the drum to various temperatures, and the subsequent cooling of the drum, the drum is susceptible to variations in its axial length, i. e., as the drum heats and cools expansion and contraction of the drum in the direction of its axial length occurs. Such expansion and contraction results in variations occurring in the lateral spacing of the ribs and grooves on or in the peripheral face of the drum.

The scrapers operating in the grooves are usually more or less rigidly connected to the common carrier and, prior to the present invention, the common carrier has been of a more or less rigid construction and was not affected in any material way by variations in the temperature of the drum adjacent which the carrier was mounted.

With the scrapers rigidly connected to the rigid carrier and operating in the grooves of the drum, which as noted above were susceptible to variations in their lateral spacing, the scrapers did not operate efficiently, because, as the drum expanded and contracted causing the lateral spacing of the ribs and grooves to vary, the scrapers were thrown out of alignment with the grooves which caused the operating ends of the scrapers to be flexed laterally, more or less, as a result of the scrapers each being rigidly connected to the rigid carrier and held firmly thereby at one end while the opposite operating end of each scraper was confined in a groove formed between adjacent ribs of the drum and by which the operating end of the scraper was moved laterally with respect to the fixed end of the scraper in accordance with variations in the length of the drum.

The object of the present invention is to mount the scrapers in such a manner that the lateral spacing of the scrapers can be varied in accordance with the variations occurring in the spacing of the ribs and grooves, to compensate for such variations and thereby provide more efficient contacting of the scrapers with the walls of the grooves and ribs.

The object of the present invention may be attained by any one of a number of different methods embodying various forms of mechanism, the simplest and preferred form of which will be fully disclosed hereinafter, reference being had to the accompanying drawings, of which

Fig. 1 is a diagrammatic plan view illustrating a drum of the fin or groove faced type with a scraper carrier mounted adjacent thereto, in accordance with the principles of the present invention;

Fig. 2 is an enlarged transverse sectional elevation, illustrating a portion of the drum and the carrier, taken on the line 2—2, Fig. 1; and

Fig. 3 is a face view of those portions of the drum and carrier shown in Fig. 2 and illustrating the scrapers operating in the grooves of the drum between the adjacent ribs thereof.

In order that a more thorough understanding may be had of the type of apparatus to which the present invention more particularly relates, reference is made to the common assignee's prior patent to Alpheus O. Hurxthal, No. 2,068,181, dated January 19, 1937. As shown in said patent, and as shown diagrammatically in Fig. 1 of the accompanying drawings, the drum 1 is of a hollow cylindrical shell construction. The drum or cylinder 1 is provided at its opposite ends with supporting trunnions 2 and 3 respectively. The trunnions 2 and 3 are rotatably mounted in

bearings 4 and 5 respectively. The bearings 4 and 5 may each form an integral part of or be rigidly secured to a suitable rigid framework 6.

The peripheral surface of the drum 1 is provided with a multiplicity of laterally spaced, circumferentially extending, substantially parallel ribs 7. Between each adjacent pair of ribs 7 is formed a circumferentially extending groove 8. Operating in each of the grooves 8 is a scraper needle or blade 9. For most efficient operation, the scrapers 9 should engage substantially the entire area of the surface of the walls of the grooves.

Prior to the present invention, as shown in the above mentioned patent, the scrapers were rigidly secured to a common carrier which extended parallel to the axis of the drum. As noted above, when the temperature of the drum varied, the drum expanded or contracted axially. The carrier for the scrapers, however, remained in a rigid fixed condition. Consequently, the scrapers were thrown out of alignment with the grooves causing the operating ends of the scrapers to be flexed from contact with the entire surface of the grooves.

In the present case the scrapers 9 are mounted on a hollow carrier 10. The carrier 10 is provided with ports 11 and 12 at one or both ends of said carrier and which communicate with the hollow interior 13 of the carrier 10. The ports 11 and 12 are connected, by pipes 11*a* and 12*a* respectively, to a suitable source of temperature controlling medium, such as steam for example, by which the temperature of the carrier 10 may be raised or lowered in accordance with variations in the temperature of the drum 1 and whereby the carrier 10 is caused to expand or contract longitudinally in accordance with the axial expansion and contraction of the drum 1.

The longitudinal expansion and contraction of the carrier 10 effects variation in the lateral spacing of the scrapers 9, to compensate for the variations in the spacing of the ribs 7 and grooves 8 which occurs as a result of the axial expansion and contraction of the drum 1, whereby the blades 9 are caused to maintain a more efficient, constant and uniform contact with the base and side wall surfaces of the grooves and ribs for more thoroughly removing dried material from said walls which has adhered thereto.

It is preferable to control the direction in which the expansion and contraction of both the drum and the carrier occur with respect to some definite point or plane in both the drum and the carrier. Preferably, the drum and carrier are anchored against axial or longitudinal movement at points located in a common plane extending transversely to each. While such an anchorage point may be located anywhere between the opposite ends of the drum and carrier to permit expansion and contraction in opposite directions at both sides of and with respect to the common anchorage plane it is more convenient to have the anchorage located at one end of the drum and carrier, whereby all the expansion and contraction will take place at one side of the anchorage solely.

In order to provide the above-noted anchorages the drum 1 is provided with an annular shoulder 15 which makes firm contact with one end 16 of the bearing 4, to prevent relative movement in one direction between the drum and the bearing 4. Movement of the drum in the opposite direction with respect to the bearing 4 is prevented by a collar 17 secured to the trunnion 2, as by one or more set screws 18, and having one surface 19 of the collar engaging the second end 20 of the bearing 4. Thus, with the one end 21 of the drum anchored against axial movement, the expansion and contraction of the drum will occur at one side of the bearing 4 and with respect to the anchorage plane indicated by the line x—x in Fig. 1.

In order to permit the above-noted axial expansion and contraction in the drum, the trunnion 3 located at the second end of the drum 1 is mounted in the bearing 5 in a manner to permit relative axial movement between said trunnion and said bearing and suitable clearance 22 is provided between the end 23 of the drum and the adjacent end 24 of the bearing 5.

The one end of the carrier 10 lying adjacent the bearing 4 for the drum 1 is likewise anchored against axial or longitudinal movement in any suitable manner, as for example, by providing a flange or fitting 25 integrally formed with or rigidly secured to the one end 27 of the carrier 10. The flange or fitting 25 is rigidly secured to the portion or side of the frame work 6 of the machine to which the bearing 4 for the drum 1 is likewise rigidly secured. The carrier 10, in the present instance, for the purpose of illustration, is shown as being secured to the frame work 6 by suitable bolts 26, 26.

The opposite end of the carrier 10, like the second end of the drum 1, is mounted in the frame 6 in such a manner as to permit free longitudinal expansion and contraction of the carrier 10. As a matter of illustration, the second end of the carrier 10 is slidably mounted in a free bearing 30 formed in or on or secured as by cap screws 31 to that portion of the frame 6 to which the free bearing 5 for the drum 1 is secured.

From the above it will be clear that, as the axial length of the drum 1 increases or decreases in accordance with a rise or fall in the temperature of said drum, it is possible, by controlling the temperature of the carrier 10, to cause said carrier to expand or contract longitudinally, sufficiently to compensate for the variations in the axial length of the drum 1. Such expansion and contraction of the carrier 10 will produce variations in the lateral spacing of the scrapers 9 which will correspond substantially to the variations occurring in the lateral spacing of the ribs 7 and grooves 8 in the peripheral face of the drum 1.

Obviously, the variations in the spacing between any two or between any relatively small number of the ribs 7 and grooves 8 is extremely slight and normally would produce no perceptible difference in the functioning of any corresponding two or relatively small number of adjacently disposed scrapers 9. However, when it is considered that there is a relatively large number of ribs and grooves in the drum and a correspondingly large number of scrapers on the carrier, the difference in the distance between the first rib at one end of the drum and the last rib at the opposite end of the drum when the drum is cool and between said first and last ribs when the drum is heated to the maximum extent becomes appreciable. When the scrapers operating in the grooves are rigidly secured to a rigid non-variable carrier this difference distributed along the length of the drum is sufficient to throw the scrapers out of line with the respective grooves and cause inefficient operation of the scrapers. However, when the carrier 10 is of the expansible and contractable type disclosed herein

no such misalignment of scrapers and grooves is presented.

In view of the fact that variation within any small group of ribs and grooves is rather insignificant it is practical to produce the scrapers 9 in the form of relatively short comb sections, one of which is shown in Fig. 3. A number of scrapers 9 are grouped together by being cut from a single plate 32, by making a series of kerfs 33 inwardly from one edge of said plate and leaving a solid back bar 34 along the opposite edge of said plate. A number of these comb sections are mounted on the carrier 10 in end to end relation to each other.

The back bar 34 of each of the above mentioned combs is secured to a swinging frame 35 by bolts 36, 36. Each swing frame 35 is provided with ears 37, 37 which are disposed at opposite ends respectively of a bracket 38. Each bracket 38 is secured to the carrier 10 by means of cap screws 39. A pivot rod 40 extends through and beyond each bracket 38 into the ears 37, 37 of the associated swing frame 35, with its axis substantially parallel to the longitudinal axis of the drum 1 and the carrier 10. Axial movement of the pivot rod 40 with respect to the bracket 38 and ears 37 is prevented by a set screw 41 threaded into the bracket and having bearing against said pivot rod.

Adjustment of the scrapers 9 in a direction transversely of the drum 1 and carrier 10, and whereby the proper pressure of the ends of the scrapers against the surface of the drum may be accurately controlled, is effected by means of nuts 42 and 43 threaded onto adjusting rods 44 which are rigidly secured in the swing frames 35 and project therefrom through slots 45 formed in extensions 46 of the brackets 38, thrust blocks 47 and 48 being provided on said adjusting rods 44 between the nuts 42 and 43 and the bracket extensions 46.

The slight variations in distances between small groups of the ribs 7 and grooves 8 are compensated for by expansion and contraction of the back bar 34 of each of the scraper comb sections, said back bar being heated by conduction from the carrier 10 through the brackets 38 and swing frames 35 and from the drum 1 through the scrapers 9 themselves. Consequently, variations in the temperature of the drum 1 and carrier 10 are reflected in the back bars 34 of the scraper comb sections, causing the back bars of said comb sections to expand and contract longitudinally together with the drum 1 and carrier 10 causing a minute variation in the lateral spacing of the individual scrapers 9, 9 on each back bar 34 and thereby compensating for the minute differences between the lateral spacing of a relatively small group of ribs 7 and grooves 8 and a correspondingly relatively small group of scrapers 9 which respectively occupy said grooves.

The heating of the carrier 10 and the consequent longitudinal expansion and contraction thereof effects variation in the lateral spacing between the groups of scrapers 9, 9, formed on the several back bars 34, 34 which are mounted in laterally spaced relation to each other along the carrier 10.

In the present instance the drum 1 is heated to the desired temperature by steam admitted through the trunnion 2 by means of a steam pipe 49, circulation within the drum being provided by the return or exhaust pipe 50 in the manner illustrated in the previously mentioned patent to Hurxthal, No. 2,068,181, said pipe 50 also serving to evacuate condensation from the lower portion of the interior of the drum 1. In a like manner, in the present instance, condensation in the lower portion of the hollow carrier 10 is evacuated through the lower ports 12 in said carrier.

While the drum 1 and carrier 10 in the present instance have been described as being heated by means of steam admitted to the interiors of said elements, it is obvious that gas or electrical heating appliances may be utilized as a substitute for the steam in either the drum or the carrier or in both without departing from the spirit of the present invention.

I claim:

1. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, and thermo-sensitive means for varying the lateral spacing of said scrapers to compensate for said variations occurring in the lateral spacing of said ribs and grooves.

2. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves with means disposed at a predetermined point along the length of said drum for preventing axial movement of the drum at said point and causing said expansion and contraction of the drum to be effected relative to said point, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, and thermo-sensitive means similarly anchored for expansion and contraction with respect to said point for varying the lateral spacing of said scrapers to compensate for said variations occurring in the lateral spacing of said ribs and grooves.

3. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves with means disposed adjacent one end of said drum for preventing axial movement of said end of said drum and causing said expansion and contraction to be effected relative to said end, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, and thermo-sensitive means similarly anchored for expansion and contraction with respect to said end of said drum for varying the lateral spacing of said scrapers to compensate for said variations occurring in the lateral spacing of said ribs and grooves.

4. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, and a thermo-sensitive carrier for said scrapers extending substantially parallel to the axis of said drum for effecting longitudinal expansion and contraction of said carrier for varying the lateral spacing of said scrapers to compensate for said variations

occurring in the lateral spacing of said ribs and grooves.

5. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves with means disposed at a predetermined point along the length of said drum for preventing axial movement of the drum at said point and causing said expansion and contraction of the drum to be effected relative to said point, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, a thermo-sensitive carrier for said scrapers extending substantially parallel to the axis of said drum, and means disposed at a predetermined point along the length of said carrier for anchoring said carrier against longitudinal movement at said point, temperature variations occurring in said thermo-sensitive carrier effecting longitudinal expansion and contraction of said carrier relative to said anchorage for varying the lateral spacing of said scrapers to compensate for said variations occurring in the lateral spacing of said ribs and grooves.

6. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves with means disposed adjacent one end of said drum for anchoring said end of said drum against axial movement and causing said expansion and contraction to be effected relative to said end, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, a thermo-sensitive carrier for said scraper extending substantially parallel to the axis of said drum, means for anchoring the end of said carrier lying adjacent the anchored end of the drum against longitudinal movement, temperature variations occurring in said thermo-sensitive carrier effecting longitudinal expansion and contraction of said carrier for varying the lateral spacing of said scrapers to compensate for said variations occurring in the lateral spacing of said ribs and grooves.

7. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, a thermo-sensitive carrier for said scrapers extending substantially parallel to the axis of said drum, and means for rigidly connecting said scrapers in groups to said carrier, temperature variations occurring in said thermo-sensitive carrier effecting longitudinal expansion and contraction of said carrier for varying the lateral spacing between said groups of said scrapers to compensate for variations occurring in the lateral spacing between corresponding groups of said ribs and grooves on said drum.

8. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, a thermo-sensitive carrier for said scraper extending substantially parallel to the axis of said drum, and means for heating said carrier to effect longitudinal expansion and contraction thereof for varying the lateral spacing of said scrapers to compensate for said variations occurring in the lateral spacing of said ribs and grooves.

9. A device for use with a drum having laterally spaced circumferential ribs and grooves intermediate said ribs, wherein said drum is subject to axial expansion and contraction producing variations in the lateral spacing of said ribs and grooves, said device comprising laterally spaced surface scrapers respectively operating in said grooves between adjacent ribs, a hollow carrier for said scrapers extending substantially parallel to the axis of said drum, and means for admitting heat to the interior of said carrier for effecting longitudinal expansion and contraction of said carrier for varying the lateral spacing of said scrapers to compensate for said variations occurring in the lateral spacing of said ribs and grooves.

10. A scraper carrier for drum driers in the form of an elongated hollow element adapted to support a plurality of scrapers in laterally spaced relation along said element, and means for heating the interior of said element to effect longitudinal expansion and contraction thereof for varying the lateral spacing between the scrapers therealong.

11. A scraper carrier for drum driers in the form of an elongated hollow element adapted to support a plurality of scrapers in laterally spaced relation along said element and ports communicating with the hollow interior of said element for admitting and exhausting a suitable fluidic heating medium to said interior for heating said element and thereby effecting longitudinal expansion and contraction thereof and a consequent variation in the lateral spacing of the scrapers therealong.

12. A scraper carrier for drum driers in the form of an elongated hollow element adapted to support a plurality of scrapers in laterally spaced relation along said element and ports communicating with the hollow interior of said element adjacent the opposite ends respectively thereof for admitting and exhausting a suitable fluidic heating medium to said interior for heating said element and thereby effecting longitudinal expansion and contraction thereof and a consequent variation in the lateral spacing of the scrapers therealong.

13. A scraper carrier for drum driers in the form of an elongated hollow element adapted to support a plurality of scrapers in laterally spaced relation along said element, means for securing said scrapers to said element in groups, and means for heating the interior of said element to effect longitudinal expansion and contraction thereof for varying the lateral spacing between the said groups of scrapers therealong.

14. A scraper carrier for drum driers in the form of an elongated hollow element adapted to support a plurality of scrapers in laterally spaced relation along said element, means for securing said scrapers to said element in groups comprising a series of back bars to each of which a plurality of scrapers is attached, means for connecting said back bars to said element in laterally spaced relation to each other therealong, and means for heating the interior of said element to effect longitudinal expansion and contraction

thereof for varying the lateral spacing between the said groups of scrapers therealong.

15. A scraper carrier for drum driers in the form of an elongated hollow element adapted to support a plurality of scrapers in laterally spaced relation along said element, means for securing said scrapers to said element in groups comprising a series of back bars to each of which a plurality of said scrapers is attached, a series of swing frames pivotally connected to said element in substantially aligned laterally spaced relation to each other for respectively supporting said back bars, and means for heating the interior of said element to effect longitudinal expansion and contraction thereof for varying the lateral spacing between the said groups of scrapers therealong.

16. A scraper carrier for drum driers in the form of an elongated hollow element adapted to support a plurality of scrapers in laterally spaced relation along said element, means for securing said scrapers to said element in groups comprising a series of back bars to each of which a plurality of said scrapers is attached, a series of swing frames pivotally connected to said element in substantially aligned laterally spaced relation to each other for respectively supporting said back bars, adjusting means for controlling the positions of said swing frames relative to the longitudinally bisecting plane of said element, and means for heating the interior of said element to effect longitudinal expansion and contraction thereof for varying the lateral spacing between the said groups of scrapers therealong.

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