

Jan. 14, 1969

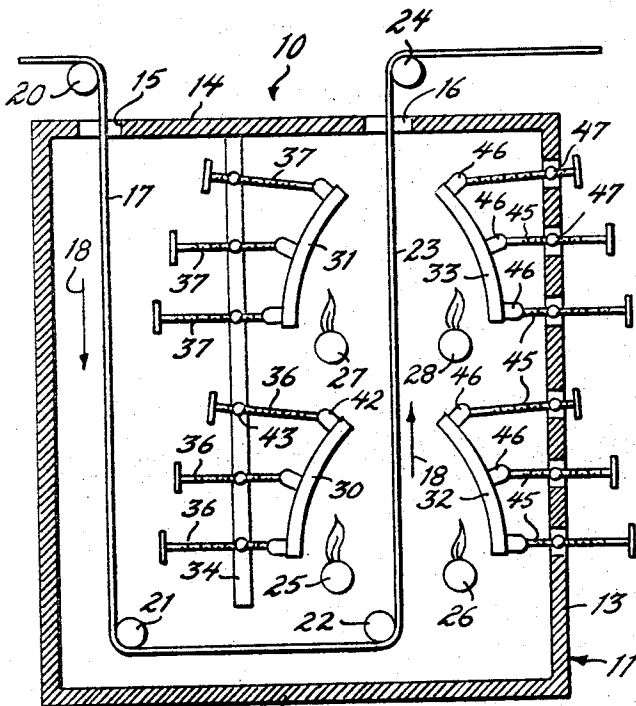
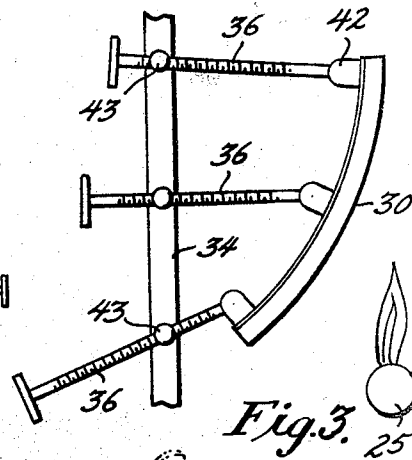
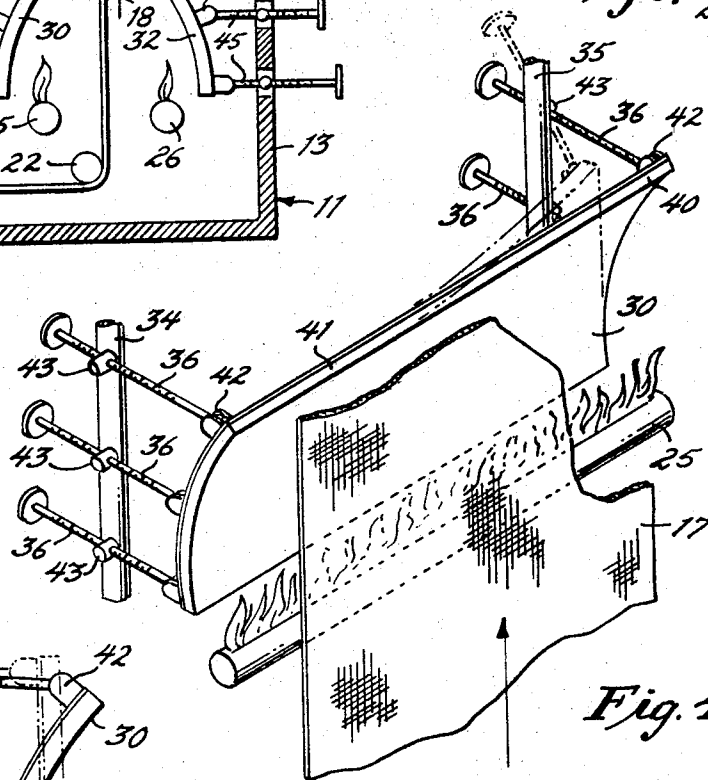
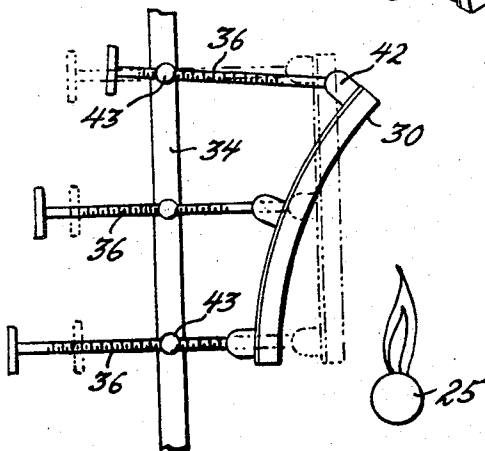
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3,421,746

HEATING APPARATUS FOR ELONGATE MATERIAL

Filed April 24, 1967

Sheet 1 of 2



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Sheet 2 of 2

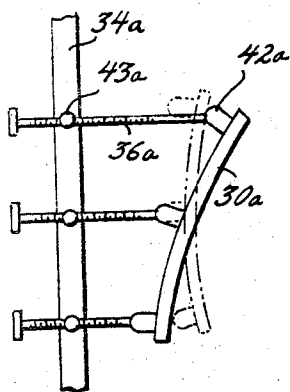


Fig. 7

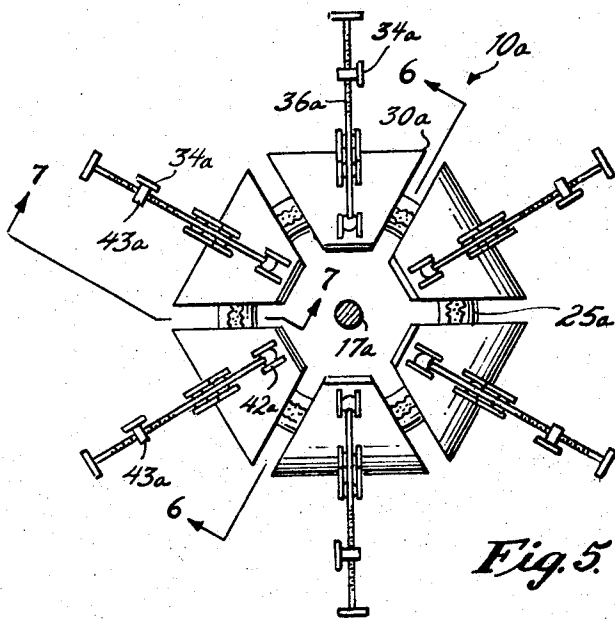


Fig. 5

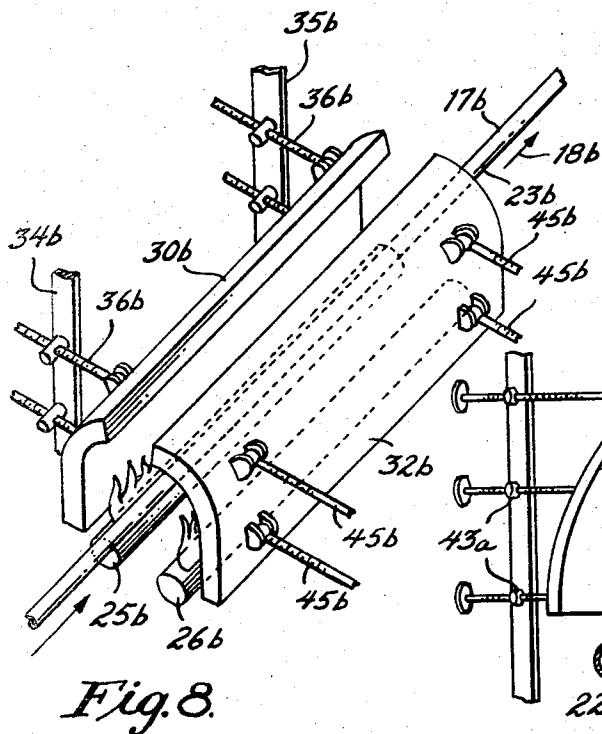


Fig. 8

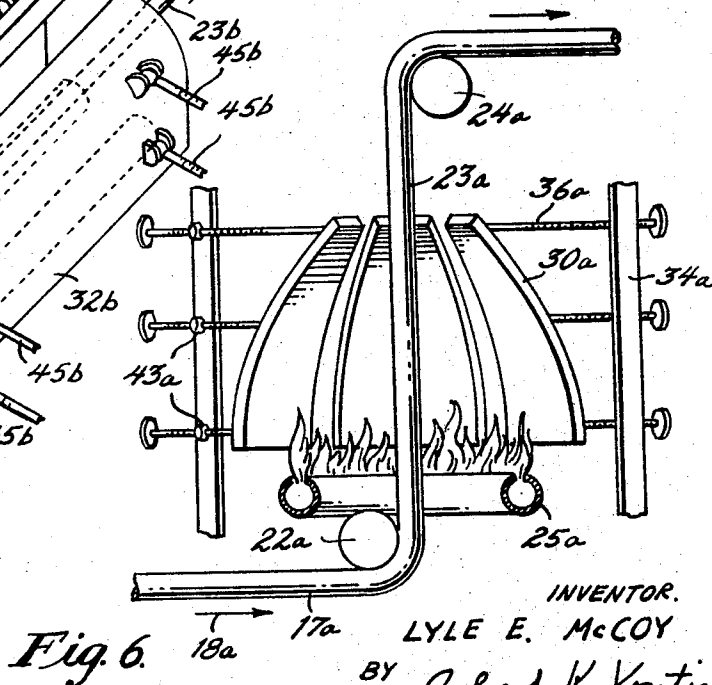


Fig. 6

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3,421,746 HEATING APPARATUS FOR ELONGATE MATERIAL

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8 Claims

ABSTRACT OF THE DISCLOSURE

This invention is concerned essentially with apparatus for heating elongate materials and includes a conveyor means for moving elongate material along a path, a heat source adjacent to the path, a flexible heat-radiating panel adjacent to the source for receiving heat from the latter and radiating the received heat to the path, and mounting means affording flexural adjustment to the panel to obtain a desired pattern of radiation.

Background of the invention

While the apparatus of the present invention has been primarily developed and employed for use in textile heating and drying, and specifically as predrying apparatus, as known in the textile trade, it is appreciated that the device of the present invention is capable of many varied applications, all of which are intended to be comprehended herein.

In devices of the prior art employed for heating and drying, serious problems existed in uniformity of heat transmission, and possible burning on shutdown. That is, an elongate material say in the form of a web or strand, was conveyed longitudinally through a heating chamber, the heat-radiating elements of which were difficult or impossible to adjust, and required considerable time to heat up and cool down. Adjustment of radiated heat in prior-art devices usually involved selected valving of gases being burned, a difficult procedure requiring expensive apparatus.

Summary

Accordingly, it is an important object of the present invention to provide heating apparatus of the type described which is extremely flexible and versatile in operation, being capable of a wide variety of selected adjustments, which are easy and precise, and wherein the construction is greatly simplified to substantially reduce initial, as well as operating costs, while achieving a highly improved result.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

Brief description of the drawing

FIGURE 1 is a sectional elevational view showing a heating apparatus of the present invention, as employed in a predrying textile procedure.

FIGURE 2 is a partial elevational view similar to FIGURE 1, but enlarged for clarity, and illustrating selected alternate positions of a radiating panel.

FIGURE 3 is a partial elevational view similar to FIGURE 2, illustrating still a further selected panel position.

FIGURE 4 is a perspective view showing the com-

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ponents of FIGURES 2 and 3 and illustrating a further aspect of panel adjustment.

FIGURE 5 is a top plan view showing a heating apparatus of the present invention particularly adapted for the heating of filamentary or strand material.

FIGURE 6 is a sectional elevational view taken generally along the line 6-6 of FIGURE 5.

FIGURE 7 is a partial sectional elevational view taken generally along the line 7-7 of FIGURE 5, illustrating alternate panel positions.

FIGURE 8 is a perspective view illustrating a further modified apparatus of the present invention in the form of a tunnel.

Description of the preferred embodiments

Referring now to the embodiment of FIGURES 1-4, and specifically to FIGURE 1, an apparatus of the present invention for heating or drying is there generally designated 10, and includes an enclosure or cabinet 11 which may have a bottom wall 12, a peripheral side wall 13 upstanding from and extending about the bottom wall, and a top wall 14 spaced over the bottom wall and extending between the upper edges of the side wall. The top wall may include a pair of openings 15 and 16 for the ingress and egress, respectively, of elongate material 17 moving in the direction of arrows 18. The material 17 may be of web type and conveyed along its illustrated path, as passing over a roll 20 and downward through the cabinet opening 15 to a lower cabinet region for passage under a roll 21 and thence horizontally for passage under an additional roll 22 and thence vertically upwardly, as along the path 23 where predrying or heating takes place, as will appear more fully hereinafter. The elongate material or web 17 passes along the path 23 upward and out through the cabinet opening 16 and over a roll 24 for movement to a further processing station.

Fixedly mounted by any suitable means in the cabinet 11 are one or more sources of heat, such as burner pipes 25, 26, 27 and 28. The burner pipes 25-28 may each be conventional, of the type known as ribbon burners, employing suitable conduit for receiving combustible gas. It will be apparent that the burner pipes 25 and 27 are located in vertically spaced relation adjacent to and on one side of the path 23, while the burner pipes 26 and 28 are located in adjacent spaced relation on the other side of the material path. Further, the burner pipes 25 and 26 may be located in horizontally spaced relation with respect to each other, as are the burner pipes 27 and 28. Thus, the burner pipes 25-28 provide sources of heat adjacent to the path 23.

Along one side of the path 23, the left-hand side as seen in FIGURE 1, are a pair of vertically spaced radiating panels 30 and 31 respectively adjacent to burners 25 and 27. A similar pair of vertically spaced radiating panels 32 and 33 are located on the other, rightward side of path 23, respectively adjacent to heat sources or burners 26 and 28.

Carried by the cabinet 11 may be a plurality of depending support members 34 and 35 located behind, or leftward of the radiating panels 30 and 31. The support members 34 and 35 carry elongate, extensible and retractile mounting members 36 and 37 respectively mounting the panels 30 and 31 on the support members.

As best seen in FIGURE 4, the panel 30, which may be identical to the remaining panels, is advantageously formed of a flexible mat 40 adhesively or otherwise fixedly secured on its back or outer side to a flexible backing sheet 41. The mat 40 may advantageously be formed of aluminum-silicate wool, or other suitable flexible, refractory, radiating material. The mounting members 36 may each have one end articularly connected, as by a suitable connector 42, to the back side of backing sheet

41. In the illustrated embodiment there are three vertically spaced mounting members or rods 36 carried by the support member 34 and connected at one end to the panel 30, while an additional three vertically spaced mounting members are carried by the support member 35 and connected adjacent to the other end of the panel. Connecting each mounting member or rod 36 to its adjacent support member 34 or 35 is an additional connector, as at 43. The mounting members or rods 36 may be externally threaded and pass in threaded engagement through respective connectors 43, while having a degree of swinging movement relative to their respective support members 34 and 35, whereby the rods 36 are extensible and retractible upon rotation thereof to selectively adjust both the position of the panel 30 and the contour thereof. Thus, the panel 30 may be moved toward and away from the path 23 being inclined at a selected angle with respect to the path, and may also be flexed to radiate a desired pattern of heat toward the path. The concave flexure of panel 30, in the direction toward path 23, is best illustrated in FIGURE 2, in solid lines, while a generally flat configuration is shown in phantom. A combination of panel contours is shown in phantom in FIGURE 4, wherein the panel is warped to achieve a desired pattern of radiation. In particular, the uniformity of heat distributed by a burner 25 may not be readily adjusted, except by the most complex and expensive of valving arrangements. However, radiation from the panel 30 to the path of material 17 may be substantially uniform by adjustment of the panel to concentrate heat at desired locations.

The panels 32 and 33 are similarly mounted by elongate, extensible and retractile mounting members or rods 45, each extending from an articular connection 46 with the back of a respective panel to a support, which may be the cabinet side wall 13. By this arrangement, the mounting members 45 extend through suitable connection elements 47 carried by the cabinet wall 13, and terminate exteriorly of the cabinet wall for selective adjustment from outside of the cabinet.

In the arrangement illustrated in FIGURE 1, it will be apparent that the panels 30 and 31 are respectively associated with heat sources 25 and 27 for receiving heat from the heat sources and radiating the received heat toward the path 23. The panels 32 and 33 have similar relationship with respect to heat sources 26 and 28. Further, the panels are each located substantially above its associated heat source, and each panel is inclined upwardly and inwardly toward the path 23. This relationship has been found particularly advantageous in that the panels serve not only their radiating relationship, but also to insulate the vertically spaced heat sources from each other, for more uniform and safe operation.

In FIGURE 3 is shown another contour of flexure of panel 30, having its radiating surface generally convex, which may be desirable under certain conditions of operation.

In the processing of material of elongate strandlike configuration, such as rope, pipe, and others, the embodiment shown in FIGURES 5-7, and generally designated 10a, may be advantageous. It will there be apparent that a strandlike material 17a passes in the direction of arrows 18a beneath a guide roll 22a, thence upwardly along a path 23a and over a guide roll 24a. A heat source or burner pipe 25a may be of elongate generally annular or ringlike configuration, spaced circumposed about the path 23a and suitably connected to a source of combustible material in the conventional manner.

An annular array of panels 30a is located above the heat source 25a surrounding the path 23a, each panel being mounted by suitable mounting elements 36a carried by fixed upstanding support members 34a. The mounting elements 36a may be of extensible and retractile character as mentioned in connection with the first-described embodiment, each having its inner end articulated by a suitable joint 42a to the back of a respective panel

30a, and supported in threaded engagement with a connector 43a carried by the associated support 34a. The panels 30a may be of essentially the same construction as the panels 30, each having a radiating mat of flexible ceramic material, such as aluminum-silicate wool fixed to a flexible metal backing sheet. However, the panels 30a may be of upwardly laterally tapering configuration to form a composite dome-like effect, rather than the rectangular configuration of the first-described embodiment.

Here again, the panels 30a are independently selectively flexible to achieve a desired pattern of heat radiation by means of the mounting members 36a and their articular connections. Of course, additional annular heat sources or ring burners may be arranged in superposed relation above each other, and provided with additional annular arrays of heat-radiating panels, to achieve greater heating or drying effect, with the advantageous insulation of vertically spaced heat sources by the panels, as described hereinbefore.

A further embodiment is shown in FIGURE 8, wherein an elongate material 17b is moved along a path 23b in the direction of arrow 18b. On opposite sides of the path 23b, extending longitudinally therealong, are a pair of heat sources 25b and 26b, such as pipe or ribbon burners having suitable connections for supply. Extending along and above respective heat sources 25b and 26b are heat-radiating panels 30b and 32b of similar construction to previously described radiating panels, including a flexible mat of aluminum-silicate wool or other ceramic material and a backing of flexible sheet material, such as metal. The panel 30b is carried by extensible and retractile members 36b suitably articulated between the panel and support members 34b and 35b. Thus, the panel 30b is mounted for selective positioning and flexural adjustment in essentially the same manner as the previously described panels. Panel 32b is similarly mounted by mounting members 45b having the necessary articular and extensible and retractile connections.

In the embodiment of FIGURE 8, it will be apparent that the heat sources 25b and 26b, and radiating panels 30b and 32b extend longitudinally of the path 23b, thereby defining a tunnellike heating or drying apparatus, in contradistinction to the heat sources and panels of the first two embodiments extending generally transversely of the path of material movement. While the elongate material 17b shown in FIGURE 8 is of the strand type, it is appreciated that a tunnel-type heater or dryer may be employed in conjunction with elongate material of the web type, if desired.

From the foregoing, it is seen that the present invention provides a heating apparatus which fully accomplishes its intended objects and is well adapted to meet practical conditions of manufacture, installation, maintenance and use.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. Heating apparatus for elongate material, comprising conveyor means for moving elongate material along a path, a heat source adjacent to said path, a flexible heat-radiating panel located adjacent to said source for receiving heat from said source and radiating received heat to said path, and mounting means mounting said panel to afford thereto a selected flexure for radiation in a desired pattern, said panel comprising a mat of ceramic fibers, and a flexible backing sheet fixed to said mat.

2. Heating apparatus according to claim 1, said mounting means comprising a fixed support, and a plurality of extensible and retractile carrier members extending between said support and backing sheet, said carrier members being selectively positionable to adjust said panel.

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3. Heating apparatus according to claim 2, said fixed support including a cabinet surrounding said path, source and panel.

4. Heating apparatus according to claim 2, said heat source being of elongate configuration and said panel extending along said heat source.

5. A heating apparatus according to claim 4, said heat source and panel extending transversely of said path.

6. A heating apparatus according to claim 4, said heat source and panel extending longitudinally of said path.

7. Heating apparatus according to claim 4, said heat source being of generally annular configuration, and a plurality of additional panels arranged together with said first-mentioned panel in an annular array generally concentric with said heat source.

8. A heating apparatus for elongate material, comprising conveyor means for moving elongate material along a path, a heat source adjacent to said path, a flexible-heat-radiating panel located adjacent to said source for receiving heat from said source and radiating received heat to said path, and mounting means mounting said panel to afford thereto a selected flexure for radiation in

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a desired pattern, in combination with an additional heat source adjacent to said path spaced there-along from said first-mentioned heat source on the other side of said panel, and an additional panel located adjacent to said additional heat source for receiving heat from said additional heat source and radiating received heat to said path, said additional panel being located on the opposite side of said additional heat source as said first-mentioned panel, whereby said first-mentioned panel is effectively interposed between said first-mentioned and additional heat sources to insulate the heat sources from each other.

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JOHN J. CAMBY, *Primary Examiner*.

U.S. Cl. X.R.

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