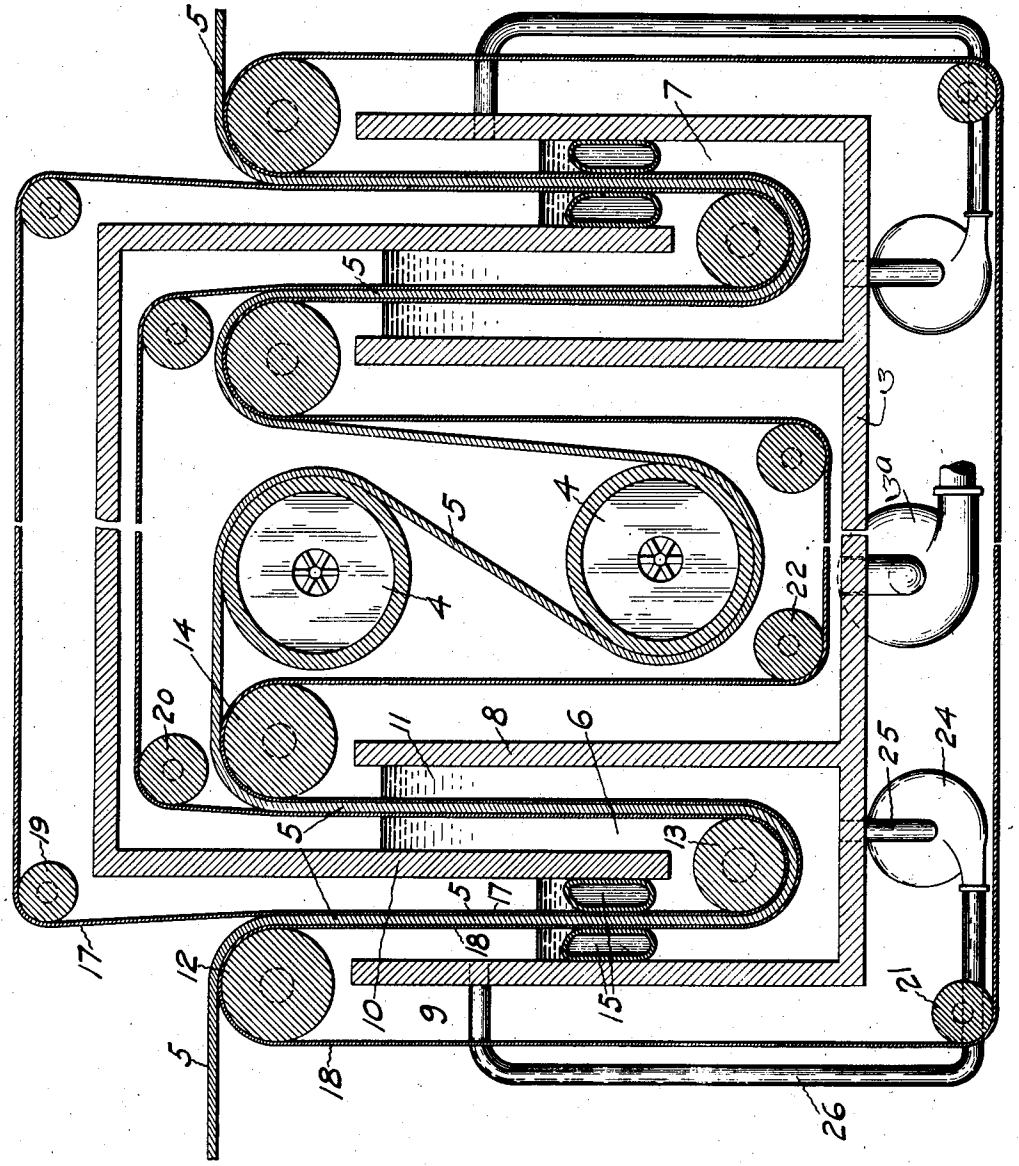
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W. G. O'BRIEN

DRYING APPARATUS FOR SHEET MATERIAL

Filed July 31, 1922



INVENTOR

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BY

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DRYING APPARATUS FOR SHEET MATERIAL.

Application filed July 31, 1922. Serial No. 578,745.

To all whom it may concern:

Be it known that I, WILLIAM G. O'BRIEN, a citizen of the United States, and resident of Akron, Ohio, have invented new and useful Improvements in Drying Apparatus for Sheet Material, of which the following is a specification.

My invention relates to apparatus for drying sheet material, and it has particular relation to means for evacuating and sealing a drying chamber for treating sheet material.

One object of my invention is to provide a sealing arrangement whereby a minimum amount of air is permitted to enter the evacuated drying chamber with the material to be dried.

Another object of my invention is to provide means for protecting the sheet material from mechanical injury, and also from contamination by the sealing fluid, while passing through the seal.

A still further object of my invention is to provide a means for retaining the vacuum in the evacuated chamber which is combined with, and forms an integral part of, the sealing arrangement.

Heretofore, it has been suggested to employ a seal for an evacuated drying chamber which consists of a body of mercury or other suitable fluid, through which material, undergoing treatment, must pass in order to reach the chamber, and in order to depart therefrom. The mercury serves the purpose of preventing any air or gases being carried by the sheet material into the evacuated chamber, thus reducing the partial vacuum therein.

Another type of seal which has been suggested consists of two resilient casings adapted to confine a fluid and which resiliently engage the sheet material as it passes therebetween, thus preventing the passage of air therewith.

In apparatus of the character referred to, certain liquid seals have been employed, in which water or other suitable liquid was permitted to enter the evacuated chamber through an opening and is pumped therefrom so as to produce, or aid in producing, a vacuum or a partial vacuum within the chamber. Ordinarily these passages have been of such a nature that a relatively large amount of water must be pumped in order to remove a relatively small amount of air from the drying chamber.

By my invention I have provided a combination sealing and vacuum producing apparatus of novel character. Briefly speaking, I have provided a covering of sheet material on both sides and at the edges of the material, while it passes through the sealing chamber, so as to protect the material from an injury of any character. Also, I have disposed resilient cushions within the liquid employed for sealing purposes, thus providing a double sealing arrangement, and by providing a suitable pumping arrangement, I have eliminated the objections heretofore encountered relative to the large quantities of water which it was found necessary to pump in order to produce and maintain the desired vacuum.

The accompanying drawing is a cross-sectional view of a portion of a drying apparatus, illustrating my invention.

In the drawing I show a container 3 having mounted therein a plurality of heated rolls 4 over which a strip of sheet material 5 is adapted to be passed to be dried. The container 3 is provided with an opening or passageway 6 at one end thereof adapted to permit the entry of sheet material 5, and an opening or passageway 7 at the opposite end thereof adapted to permit the exit of the sheet material 5. Each of the openings 6 and 7 is formed by enclosing walls, including the two upwardly extending walls 8 and 9, between which is positioned a downwardly extending wall 10. The three walls together form a channel or passageway of substantially U-shape in which is disposed a body of water, or other suitable liquid 11, which is adapted to prevent the introduction of air to the chamber 3, which is evacuated by means of an air pump 3^a to assist in the drying operation. The sheet material 5 enters the container by passing over an idling pulley 12, disposed outside the container, down through the outside leg of the U-shape passageway, over an idling pulley 13 disposed in the bottom of said channel and immersed in the body of liquid 11, up through the inside leg of the U-shape passageway, over an idling pulley 14, and to the heated rolls 4.

To assist in preventing the admission of air to the container 3, the outside leg of the

U-shape passageway is provided with two oppositely disposed similar containers 15 having a fluid, usually mercury, confined therein. The containers 15 are immersed within the liquid 11, and tend to engage both surfaces of the sheet material 5, one being disposed on each side thereon. In order to prevent friction between the sheet material 5 and the fluid containers 15, I have provided two endless belts 17 and 18 which move with the sheet material 5, one on each side thereof, while it is passing through the seal, but move out of engagement therewith when the material enters the drying chamber. The belt 17 passes over an idling pulley 19, disposed outside and on top of the container wall 10, passes down to the idler pulley 12, and there engages the sheet material 5. It is held in close engagement with the material 5 as it passes through the liquid 11, between the members 15, finally leaving the sheet material 5 at the idler pulley 14 and passing over a pulley 20. Both ends of the container 3 are exactly similar, and, therefore, a description of one sealing arrangement applies equally well to the other. The belt 18 passes over an idling pulley 21, disposed outside of and below the wall 9 of the container 3, passes over the idling pulley 12, there engaging the sheet material 5 and passing in close contact therewith through the liquid body 11 and between the fluid containers 15, finally leaving the material after passing over the idling pulley 14 and passing to the lowermost portion of the container 3 and over the idling pulley 22.

From the foregoing description, it will be apparent that I have provided a double sealing arrangement by immersing the liquid containers 15 within the liquid 11. Also, that the belts 17 and 18 will prevent any injury whatsoever from the containers 15, and any contamination from or association with the liquid body 11.

In order to maintain the seal in the openings 6 and 7, I provide liquid pumping devices 24 disposed at the ends of the container 3, and connected by means of pipes 25, so as to pump the liquid from the U-shape passageway on the drying chamber side of the restriction or air containers 15, and to deliver it by means of pipes 26 to the U-shape passageway on the open side of the restriction or fluid containers 15. The body of liquid maintained above each sealing device serves to prevent the passage of air therethrough with the sheet material. This liquid is gradually drawn through the seal but is replenished by the pump 24 from the U-shape passageway.

It will be apparent from the foregoing description that owing to the restriction, caused by the fluid containers 15, in the outer leg in the U-shaped passageway, that the amount of liquid which will flow therethrough will be relatively small, thus permitting the use of relatively small pumps 24 which may be regulated to maintain the proper level of liquid on the open side of the U-shaped passageways.

From the foregoing description it will be apparent that I have provided an apparatus which avoids the danger of injury to the sheet material by friction with the fluid containers 15, which eliminates the possibility of contamination of the sheet material from the liquid 11, and which provides a novel type of evacuating seal retaining mechanism, which possesses numerous advantages over those heretofore suggested.

Although I have illustrated but one form of my invention, and have described in detail but a single application thereof, it will be apparent to those skilled in the art, that it is not so limited, but that various minor modifications and changes may be made therein without departing from the spirit of my invention, and I desire that it be limited only by the scope of the accompanying claims.

What I claim is:

1. An apparatus for drying sheet material comprising a container having an opening for the passage of sheet material, having heating elements contained therein and means for sealing said opening comprising a resilient cushion adapted to engage means disposed intermediate said sheet material and said cushion to protect the former.

2. An apparatus for drying sheet material comprising a container having an opening therein for the passage of sheet material, and means for sealing said opening comprising a resilient cushion adapted to engage means disposed intermediate said cushion and said sheet material and adapted to move with the latter.

3. An apparatus for drying sheet material comprising a container having an opening therein for the passage of sheet material, and means for sealing said opening comprising a resilient cushion in engagement with means adapted to protect the sheet material from direct contact with the cushion.

4. An apparatus for drying sheet material comprising a container having an opening therein for the passage of sheet material, means for sealing said opening comprising a resilient cushion in engagement with means adapted to protect the sheet material from the cushion comprising an endless belt disposed between said cushion and said sheet material, and adapted to move therewith.

5. An apparatus for drying sheet material comprising a container having a plurality of openings therein for the passage of sheet material, means for sealing said openings comprising two oppositely disposed resilient members having fluid confined therein ar-

ranged within each opening, and two endless belts both adapted to pass through the container and between the two resilient members in the openings, one of said belts being disposed on each side of the sheet material while passing through the openings in the container.

6. Apparatus for drying sheet material comprising an internally heated container provided with an opening, means for maintaining a seal on said opening and means for maintaining a partial vacuum in the container.

7. Apparatus for drying sheet material comprising a container provided with an opening, and means for sealing said opening comprising a body of liquid sheet protective and a resilient member adapted to engage the protected sheet material immersed therein.

8. Apparatus for drying sheet material comprising a container provided with a plurality of substantially U-shape openings through which the sheet material is adapted to pass, a body of liquid in each of said U-shape passageways, and resilient fluid containing means adapted to engage the sheet material and immersed in the fluid.

9. An apparatus for drying sheet material comprising a container having a heating means adapted to engage a moving strip of sheet material, means for creating a partial vacuum in said container and, passageways through which the sheet material moves including liquid seals adapted to maintain the partial vacuum.

10. Apparatus for drying sheet material comprising an evacuated container having a plurality of substantially U-shape passageways thereinto through which the sheet material is adapted to pass, a body of liquid disposed within said U-shape passageways, a restriction in said passageways, and means for removing the liquid from the passage on the evacuated side of said restriction and again admitting in to the passageway on the open side of said restriction.

11. An apparatus for drying sheet material comprising a partially evacuated container having heating elements adapted to engage a moving strip of sheet material, and means for conducting the sheet through seals adapted to maintain the partial vacuum within the container comprising endless belts disposed in engagement with either side of the sheet material and adapted to conduct the sheet through a liquid sealing medium.

12. Apparatus for drying sheet material comprising an evacuated container having a plurality of substantially U-shape passageways thereinto through which protectively reinforced sheet material is adapted to pass, a body of liquid disposed within said U-shape passageways, a restriction in said passageways, and means for removing the liquid from the passageway on the evacuated side of said restriction and again admitting it to the passageway on the open side of said restriction, said restriction comprising a resilient casing having a fluid confined therein and adapted to engage the protected sheet material passing through said passageway.

13. Apparatus for drying sheet material comprising an evacuated container having a plurality of substantially U-shape passageways thereinto through which the protectively reinforced sheet material is adapted to pass, a body of liquid disposed within said U-shape passageways, a restriction in each of said passageways comprising two resilient casing members having a fluid confined therein, and adapted to engage the protected sheet material passing therethrough, and a pump for removing the liquid from the evacuated side of the restriction and admitting it on the open side thereof.

14. Apparatus for drying sheet material comprising an evacuated container having a plurality of substantially U-shape passageways thereinto through which the sheet material is adapted to pass, a body of liquid disposed within said U-shape passageways, restrictions in said passageways, and means for removing the liquid from the passageways on the evacuated side of said restrictions and again admitting it to the passageways on the open side of said restrictions, and means for protecting said material from said restrictions comprising an endless belt interposed therebetween and adapted to move with the material.

15. Apparatus for drying sheet material comprising an evacuated container having a plurality of substantially U-shape passageways therein through which the sheet material is adapted to pass, a body of liquid disposed within said U-shape passageways, a restriction in said passageways, and means for removing the liquid from the passageways on the evacuated side of said restriction and again admitting it to the passageways on the open side of said restriction, said restriction comprising a resilient casing having a fluid confined therein adapted to engage the sheet material passing through said passageways, and means for protecting said material from said casing comprising two belts disposed betwen the casing and the sheet material, one of said belts being disposed on each side of said sheet material, and both being arranged to move therewith.

16. Apparatus for drying sheet material comprising an evacuated container having a plurality of substantially U-shape passageways thereinto through which the sheet material is adapted to pass, a body of liquid

disposed within said U-shape passageways, restrictions in said passageways comprising two resilient cushion members having a fluid confined therein and adapted to engage the sheet material passing therethrough, and a pump for removing the liquid from the passageways on the evacuated side of the restrictions and admitting it on the open side thereof, and two endless belts disposed intermediate said cushion members and said sheet material and adapted to move with said sheet material.

In witness whereof, I have hereunto signed my name.

WILLIAM G. O'BRIEN.