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3,417,486

DRYING KILN

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3 Sheets-Sheet 1

FIG. 1

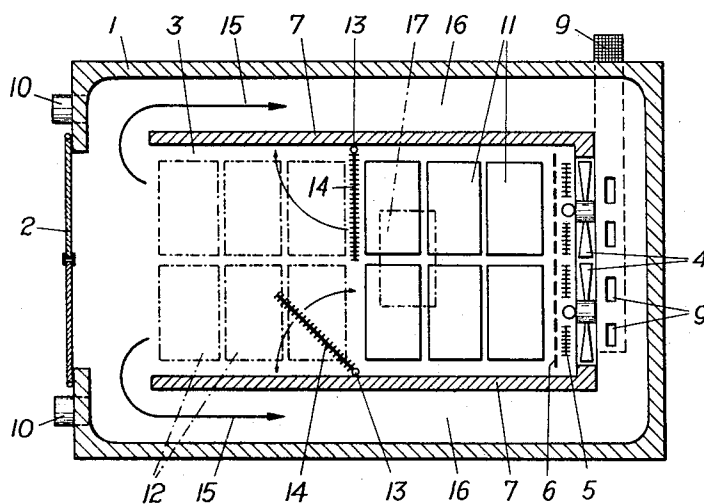
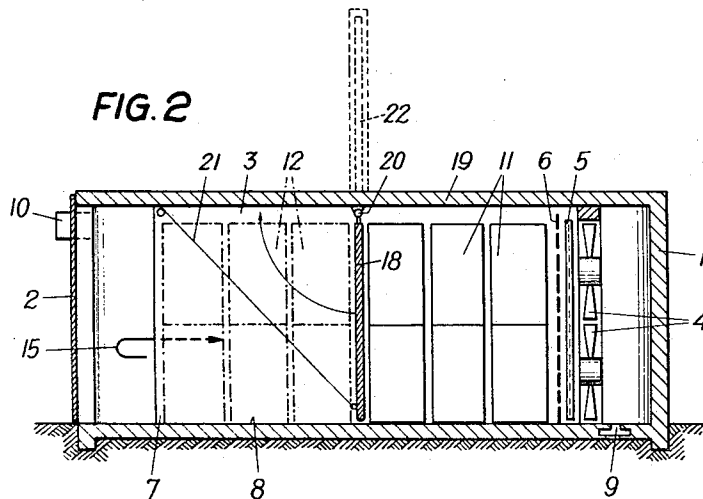


FIG. 2



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FIG. 3

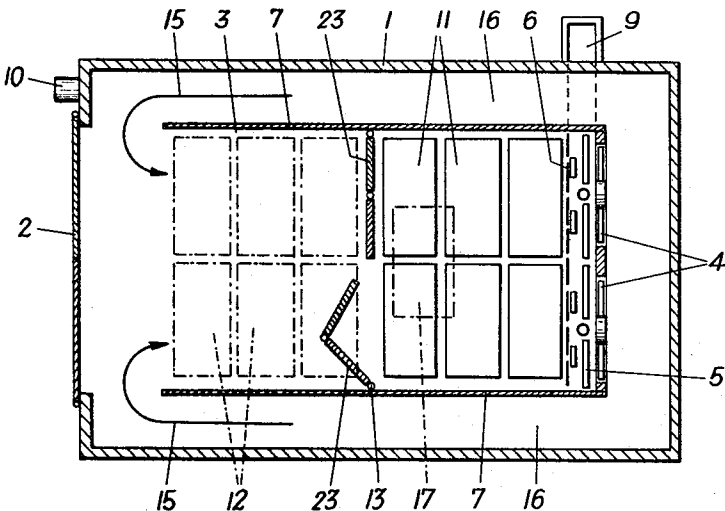
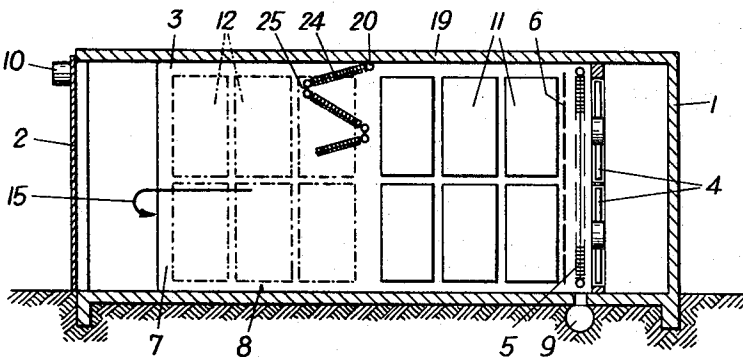


FIG. 4



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FIG. 5

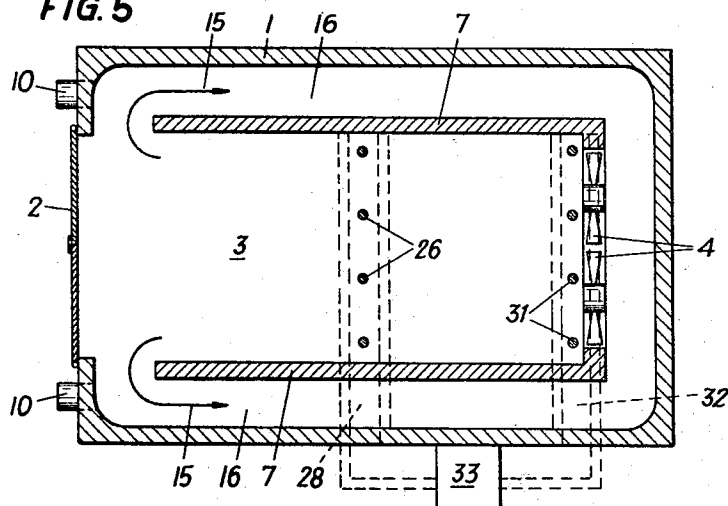


FIG. 6

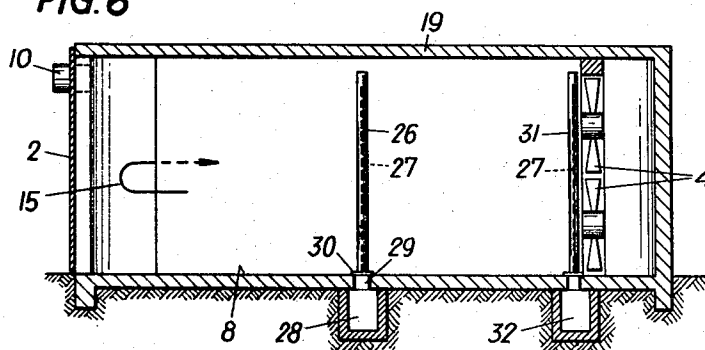
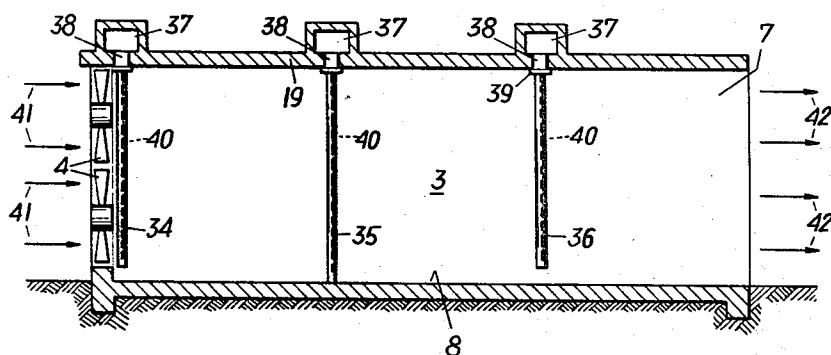


FIG. 7



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DRYING KILN

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A 2,308/66

15 Claims. (Cl. 34-218)

ABSTRACT OF THE DISCLOSURE

This invention relates to a drying kiln having a drying chamber for drying goods and more specifically is concerned with the arrangement of the heat input means. At least one part of the heat input means is removably placed in the drying chamber between areas which receive the drying goods. The part is removable for loading and unloading operations and is adapted to reheat the gaseous drying medium circulating through the drying chamber.

This invention relates to a drying kiln or drying plant comprising a drying chamber for drying goods, heat-input appliances for the drying chamber and fans for the circulation of a gaseous drying medium through the drying chamber, the drying chamber having side walls, a ceiling, a floor and spaces being provided to receive the drying goods.

The known drying kilns of that type very often have a drying chamber fitted on one side with fans and heat-input appliances, e.g., radiators, and one front end open. For example a drying kiln for stacked goods is known in which a fixed heating appliance is arranged on one side of the drying chamber whereas the fan is mounted on a mobile support. These types present a disadvantage where loading is concerned. An important disadvantage of said known drying kilns consists in the deterioration of the gaseous drying medium preventing the construction of larger drying kilns.

The principal object of this invention is to completely eliminate said disadvantages in a drying kiln of the first mentioned type.

According to the invention said problem is solved by providing a drying kiln comprising a drying chamber for drying goods, heat-input appliances for the drying chamber and fans for the circulation of a gaseous drying medium through the drying chamber, the drying chamber having side walls, a ceiling, a floor and spaces being provided to receive the drying goods, a free space being located between said spaces, at least one part of the heat-input appliances being movable and adapted to be placed in the free space between the spaces provided to receive the drying goods in the drying chamber.

Due to this movable heat-input appliance that can be placed in the free space between the spaces receiving the drying goods it is possible to arrange a number of heat-input appliances in series in any system without interfering with the loading of the drying chamber, thus allowing intermediate heating or drying of the gaseous drying medium, in particular of the air or steam flowing through the drying chamber, so that even if the length of the drying chamber is considerably increased the deterioration of the gaseous drying medium, as occurs in any stack of drying goods, is kept well within the permissible limits. This increase in the length of the drying chamber made possible in this way considerably reduces the specific costs of a drying kiln. Intermediate heating reduces the relative humidity of the drying medium, which increases the readiness of the drying medium to absorb water, whereby in addition, apart from the possible input

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of additional energy of flow, a smaller drop in moisture in the goods between inlet and outlet of the circulated drying medium in the drying chamber can be achieved.

When actually constructing the kiln it is an advantage if at least one of the heat-input appliances can swing into the spaces provided between the drying goods in the drying chamber. In this case at least one heat-input appliance can be made to pivot around a vertical shaft arranged preferably adjacent to a side wall of the drying chamber, and/or at least one heat-input appliance can be made to pivot round a horizontal shaft preferably arranged adjacent to the ceiling of the drying chamber, both vertical and/or horizontal shafts running substantially transversely to the drying chamber. Another or additional arrangement consists in making at least one heat-input appliance able to slide from one side or from above into the spaces between the drying goods in the drying chamber.

Another embodiment of the invention which is of particular advantage for drying chambers of large cross section resides in the provision of foldable heat-input appliances.

In a preferred embodiment of the invention the movable heat-input appliances consist of tubes comprising walls having apertures adapted for supplying hot gas into the drying chamber.

The invention will now be described with reference to the drawing, of which:

FIG. 1 is a plan view of a drying kiln;

FIG. 2 is a longitudinal section of another type of embodiment;

FIG. 3 is a plan view of a third type;

FIG. 4 is a longitudinal section of a fourth type;

FIG. 5 is a plan view of a preferred type of a drying kiln;

FIG. 6 is a longitudinal section of the drying kiln shown in FIG. 5; and

FIG. 7 is a longitudinal section of another preferred type of a drying kiln.

FIG. 1 shows a timber drying kiln with a chamber 1, a door 2 and a drying chamber 3. The latter is provided at one end with fans 4, heating equipment 5 in the form of radiators and a guard grille 6. The drying chamber 3 comprises side walls 7, a ceiling and a floor 8. Furthermore a fresh-air inlet 9 and exhaust-air outlet 10 are provided. The drying chamber 3 is adapted to take up the drying goods indicated by stack 11 and 12 arranged on the floor 8. In the area of the closed side walls 7 of the drying chamber 3 vertical shafts 13 are mounted around which heat-input appliances in the form of radiators 14 are pivotably arranged. The drying chamber 3 is loaded by introducing stack 11 of the drying goods by means of a fork-lift truck for example, whereupon the mobile radiators 14 are swung-in, and then stack 12, indicated in dotted lines, is introduced. Door 2 is then closed and chamber 1 is heated by means of the heating equipments 5 and 14, and the air in the kiln is circulated by means of the fans 4 in direction of the arrows 15. The air used as gaseous drying medium flows through the drying chamber 3 and is led back from the outlet end to the inlet end through channels 16 provided along the drying chamber 3. The swingable radiators 14 may be heated by way of flexible feed pipes, e.g., hoses, by means of hot water or steam.

In order to obtain a favorable air-flow with drying goods taking up only part of the width of the drying chamber 3 as indicated for example under 17 and drawn in dotted lines, the swingable radiators 14 are fitted with adjustable shutters or louvers for regulating the cross-sectional area of aperture for the circulated air.

The drying kiln in FIG. 2 presents essentially the same

parts and method of operation as the type represented in FIG. 1, but at least one mobile heating equipment 18 is mounted so as to pivot around a horizontal shaft 20, located on the ceiling 19 of chamber 3, running transversally to the drying chamber. The heater 18 may for instance be pulled up to the ceiling 19 by means of a rope 21.

As indicated in dotted lines in FIG. 2, a mobile heating appliance 22 may also be pulled upwards and out of the drying chamber 3. This type offers the advantage that the heating appliance 22 can be moved in or out of the drying chamber 3 even after the drying chamber has been loaded with drying goods 11, 12.

In the case of drying kilns of greater length it is possible, of course, to arrange several heat-input appliances 14, 18 or 22 in series in the drying chamber, the distances between said appliances being such that the condition of the gaseous drying medium in the chamber does not deteriorate too much due to the moisture given off by the drying goods. In one and the same kiln it is also possible to use heating appliances 14, 18 or 22 that are movable in different ways. In very large kilns for example it is advantageous to provide the lateral heat-input appliances pivotable around vertical shafts, as illustrated in FIG. 1 in the case of the radiators 14, and to provide central heat-input appliances or the like pivotable around a horizontal shaft 20, as shown in FIG. 2. It is also possible to run the heat-input appliance into drying chamber 3 from the side. These heat-input appliances or devices 5, 14, 18, 22 are preferably heated by electricity, hot-water, steam or hot air or hot gas as the case may be. It is also possible, however, to blow hot air or hot gas into the drying chamber 3 by means of the mobile heat-input appliances. If required, protective gas or steam may be circulated in the kiln, instead of air.

For drying kilns of greater length additional fans may be arranged on one part at least of the mobile heat-input appliances 14, 18 and 22, respectively. To facilitate quicker loading of the drying chamber 3, the fans 4, heating equipment 5 as well as the guard grille 6 provided on the inner end of the drying chamber may be swung out through a second door at the appropriate chamber end. In this case, when both doors are opened, open-air drying with partial or full operation of the mobile heat-input appliances may be carried out.

The drying kiln or drying plant shown in FIG. 3 comprises generally the same elements as the embodiment according to FIG. 1, but the pivotable heat-input appliances 14 are replaced by foldable heat-input appliances 23 mounted to supports e.g. shafts 13 vertically arranged adjacent to the side walls 7 of the drying chamber 3. Said foldable appliances 23 are adapted to be placed in the drying chamber 3 in the manner of a foldable door. Guide rails may be provided in the floor 8 and in the ceiling 19 of the drying chamber, for guiding the heat-input appliances 23 formed, e.g., by pivotably connected radiators.

The drying kiln according to FIG. 4 comprises essentially the same elements and the same method of operation as the type represented in FIG. 3, but at least one foldable heat-input device or appliance 24 is mounted to a horizontal support, e.g., shaft 20, located on the ceiling 19 of the drying chamber 3, said support running transversely to said chamber. The foldable heat-input device 24 may be pulled up to the ceiling 19 by means of a rope for instance.

The single stiff elements of each foldable heat-input appliances 23, 24 are connected plially preferably by means of shafts or joints 25. For supplying heat energy said single elements are preferably connected together by means of flexible cables or hoses according to the type of energy, but the supplying being also possible by means of suitably formed hollow joints, preferable by means of the supporting joints. These heat-input appliances 23 and 24, respectively, are preferably heated by electricity,

hot-water, steam, hot air or hot gas as the case may be. It is also possible to blow hot air or hot gas into the drying chamber 3 by means of the movable heat-input appliances. If required, protective gas or steam may be circulated in the kiln, instead of air.

The methods of operations and additional embodiments referred to in illustrating FIG. 1 and 2 are applicable to the drying kilns shown in FIGS. 3 and 4.

A preferred embodiment of a drying kiln is shown in FIGS. 5 and 6. Said kiln comprises essentially the same parts and the same method of operation as the types represented in FIGS. 1 to 4, but the movable heating appliances are formed as tubes or pipes 26. Said tubes or pipes 26 serve to supply hot gas to the drying chamber 3. For this purpose said tubes 26 comprise walls having apertures 27 for the hot gas to pass through. Said apertures 27 may be formed as slots.

A channel 28 is provided under the floor 8 of the drying chamber 3, the channel lying transversely to said chamber. Said channel 28 serves to supply hot gas to the tubes 26 and is connected to the drying chamber 3 by means of openings 29. Each of said openings 29 of the channel 28 is adapted to receive one end of one of said tubes 26. Adjacent to said end each tube 26 may have a flange 30 adapted to rest on the floor 8 of the drying chamber.

Adjacent to the fans 4 tubes 31 are stationarily arranged, said tubes having likewise apertures 27 to supply hot gas to the drying chamber 3. The tubes 31 are supplied with hot gas by means of a channel 32 provided likewise transversely under the floor 8 of the drying chamber 3. In practice both channels 28 and 31 are preferably connected together and are commonly supplied with hot gas from a chamber 33. Said hot gas is formed by preference of hot combustion gases of natural gas.

The operation of a drying kiln of this type takes place in such a manner that at first the space between the tubes 31 and the tubes 26 which have been removed is filled with drying goods, then the tubes 26 are placed and finally the remaining parts of the drying chamber 3 are loaded with drying goods. The tubes 26 preferably are manufactured from a light material, e.g., aluminium, so that said tubes may be handled by hand and inserted into the openings 29.

The drying kiln or drying plant shown in FIG. 7 comprises a drying chamber 3, fans 4 and heat-input appliances formed as tubes 34, 35 and 36, respectively, arranged in lines, the drying chamber having side walls 7, a floor 8 and a ceiling 19. Channels 37 are arranged transversely above the ceiling 19 of the drying chamber 3, said ceiling having openings 38 connecting said channels to said tubes 34, 35 and 36, respectively. All tubes 34 arranged side by side may be fastened rigidly to the ceiling 19. All tubes 35 and 36 are mounted detachably, e.g., like shown in FIG. 7 by tube 35, inserted with their upper ends into the openings 38 and standing on the floor 8 with their lower ends or, like shown by tube 36, hanging and fastened by means of a slide catch or bayonet union 39. All tubes 34, 35 and 36 comprise walls having apertures 40 preferably formed as slots, said apertures delivering hot gas to the drying chamber 3, said hot gas being supplied into said tubes by means of the channels 37 through the openings 38. The operation of a drying kiln of this type takes place essentially in the same manner as mentioned as to the kiln shown in FIGS. 5 and 6, fresh air flowing in as shown by arrows 41, and dissipated drying medium discharging as shown by arrows 42.

While some embodiments of the invention have been described for the purpose of illustration, it should be understood that the invention is not limited to the exact apparatus and arrangement of apparatus illustrated, as modifications thereof can be suggested by those skilled in the art without departure from the essence of the invention.

What I claim is:

1. A drying kiln comprising a drying chamber for drying goods therein and having spaced interconnecting side walls, end walls, a ceiling and a floor, heat-input means disposed in said chamber, fan means for circulating a gaseous drying medium through said drying chamber, at least one part of said heat-input means being removably mounted in said chamber spaced from the ends thereof to define at least first and second goods receiving compartments in said chamber.

2. A drying kiln as claimed in claim 1 wherein said at least one part of said heat-input means is pivotally mounted to be swung into said chamber between the drying goods received therein.

3. A drying kiln as claimed in claim 2 wherein said at least one part of said heat-input means is pivotally mounted about a vertical axis which is substantially adjacent one side wall of said chamber, said heat-input means comprising a radiator.

4. A drying kiln as claimed in claim 1 wherein said at least one part of said heat-input means is pivotally mounted about a horizontal axis substantially adjacent the ceiling of said drying chamber and lying substantially transverse to the drying chamber, said heat-input means comprising a radiator.

5. A drying kiln as claimed in claim 2 further comprising at least one longitudinally directed channel means interconnecting the ends of said drying chamber to recirculate said gaseous drying medium therethrough.

6. A drying kiln as claimed in claim 1 wherein said at least one part of said heat-input means is foldable.

7. A drying kiln as claimed in claim 6 wherein said foldable heat-input means is mounted to fold against at least one side wall of the drying chamber in the manner of a folding door.

8. A drying kiln as claimed in claim 7 further comprising guide rail means formed in the floor and ceiling of the drying chamber for guiding said foldable heat-input means during its movement.

9. A drying kiln as claimed in claim 6 wherein said foldable heat-input means is mounted to be folded upwards against the ceiling of said drying chamber.

10. A drying kiln as claimed in claim 6 further comprising at least one longitudinally directed channel interconnecting the ends of said drying chamber to recirculate said gaseous drying medium therethrough.

11. A drying kiln as claimed in claim 1 wherein said at least one part of said heat-input means comprises a plurality of tubes detachably mounted extending into said drying chamber, a plurality of apertures formed in each said tube and conduit means to supply said gaseous drying medium to said tubes.

12. A drying kiln as claimed in claim 11 wherein said conduit means comprises at least one conduit extending substantially transversely of said drying chamber and having openings therein to receive said tubes.

13. A drying kiln as claimed in claim 12 wherein said conduit means is arranged under the floor of said drying chamber.

14. A drying kiln as claimed in claim 12 wherein said conduit means is arranged above the ceiling of said drying chamber.

15. A drying kiln as claimed in claim 11 further comprising at least one longitudinally directed channel interconnecting the ends of said drying chamber to recirculate said gaseous drying medium therethrough.

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U.S. Cl. X.R.

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