Feb. 12, 1924. 1,483,554

E. L. RINMAN ET AL

FURNACE FOR DRY DISTILLATION OF WASTE LIQUORS AND SIMILAR MASSES

Filed June 6, 1921

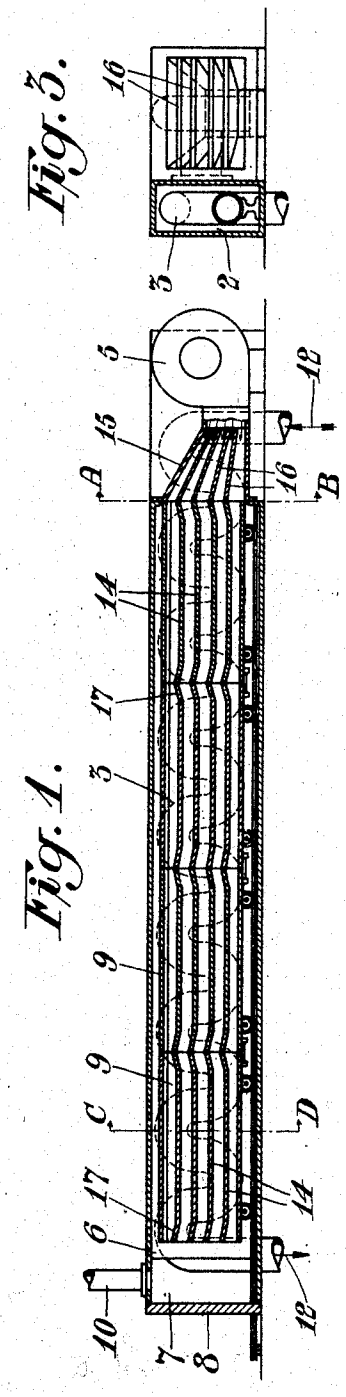

Fig. 1.

Fig. 3.

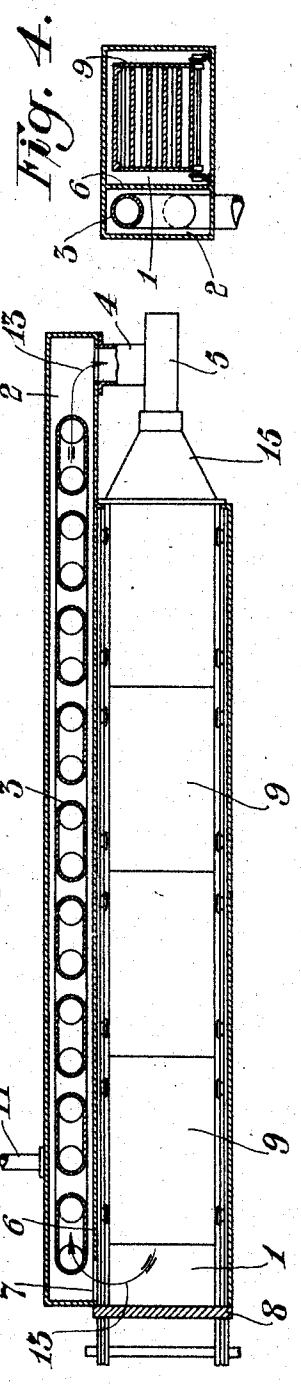

Fig. 2.

Fig. 4.

Inventors:
ERIK LUDVIG RINMAN
GUNNAR FREDRIK MAGNUSON
By George Bayard Jones, atty.

Patented Feb. 12, 1924. 1,483,554

UNITED STATES PATENT OFFICE.

ERIK LUDVIG RINMAN, OF DJURSHOLM, AND GUNNAR FREDRIK MAGNUSON, OF SKOGHALL, NEAR KARLSTAD, SWEDEN, ASSIGNORS TO AKTIEBOLAGET CELLULOSA, OF STOCKHOLM, SWEDEN, A COMPANY OF SWEDEN.

FURNACE FOR DRY DISTILLATION OF WASTE LIQUORS AND SIMILAR MASSES.

Application filed June 6, 1921. Serial No. 475,268.

To all whom it may concern:

Be it known that we, ERIK LUDVIG RINMAN and GUNNAR FREDRIK MAGNUSON, subjects of the King of Sweden, and residents, respectively, of Djursholm, Sweden, and Skoghall, near Karlstad, Sweden, have invented a new and useful Improvement in Furnaces for Dry Distillation of Waste Liquors and Similar Masses, of which the following is a specification.

The present invention relates to a furnace for dry distillation of waste liquors, for instance from pulp mills, and similar masses. The inventors have previously constructed a furnace for this purpose in which furnace the heat required for the dry distillation is supplied to the mass to be distilled directly through the gases of distillation, or through said gases together with steam supplied to the same, by such gases being alternately brought into contact with the mass and with heat radiators located in a heat chamber communicating with the distillation chamber of the furnace. In the practical use of this furnace it has been found, however, that it possesses a few disadvantages one of which is that the resistance to the movement of the gases in the furnace becomes so great that much power is consumed for driving the fan producing the circulation of the gases, and the other of which disadvantages is that a time-wasting and expensive manual labour is required for charging the trucks with the mass to be dry distilled and for removing the residue of the dry distillation from the trucks. These disadvantages are very much decreased in the furnace forming the subject of the present invention, and a few other improvements have also been made.

The invention consists principally in this that the gases are forced through the chamber of distillation in the horizontal direction over the distillation mass which is spread in thin layers on floors of trucks which are placed in a row in the distillation chamber and are connected with one another in such manner that each floor forms a continuous horizontal passage throughout the entire row of trucks. In this manner the resistance to the flow of the gases becomes considerably decreased, and at the same time the heat of the gases will be utilized as completely as possible. The circulating gases flowing through such a passage will sweep directly against the upper surface of a layer and simultaneously heat indirectly from below the layer on the floor immediately above. The distillation chamber is suitably provided at one end with an opening for introducing and removing the trucks, and communicates at the opposite end with the heat chamber through an opening arranged in such manner that the innermost truck of the row may be tightly connected with the opening. In this manner the gases flowing from the heat chamber are caused to flow directly into the horizontal passages formed by the floors of the trucks. In order to distribute the gases in the proper manner into the different passages it is preferred to provide in said opening connecting the heat chamber with the distillation chamber one or several partitions, immediately in front of which distributing partitions the fan is placed which serves to force the gases through the distillation chamber so that the heated gases become well mixed with each other immediately before they are distributed into the different passages.

In the accompanying drawing an embodiment of the invention is illustrated by way of example. Fig. 1 shows a vertical longitudinal section through the distillation chamber and the trucks in said chamber, of a distillation furnace according to the invention, and Fig. 2 shows the same furnace in horizontal section through the distillation chamber and the heat chamber. Fig. 3 is a transverse section on the line A—B in Fig. 1, and Fig. 4 is a section on the line C—D in Fig. 1.

The furnace illustrated consists of an elongated distillation chamber 1 and a heat chamber 2 placed alongside of said distillation chamber 1 and in which the heat radiators 3 are located. It has been found that it is difficult to obtain sufficient tightness of furnaces of this type, and the entire furnace is therefore preferably made of sheet iron. Such a furnace radiating much heat, however, it is preferred to insulate the same by means of an exterior brickwork, not illustrated in the drawing, which is provided at such distance from the furnace walls that between said walls and the brickwork there will be a heat insulating air-space. If sev-

eral furnaces are built one alongside the other, they may be separated from each other by means of thinner brickwork.

The distillation chamber 1 and the heat chamber 2 communicate with one another at both ends, namely at the rear end—to the right in Figs. 1 and 2—through the pipe 4 and the fan 5, and at the front end by the partition 6 ending at a distance from the front end of the furnace, so that an opening 7 is formed at this end. The distillation chamber is provided at the front end—to the left in Figs. 1 and 2—with an opening to be closed by means of a door 8 and serving for introducing and removing the trucks 9 which are preferably adapted to run on rails so that they form a continuous row which fills practically completely the entire distillation chamber with the exception of the part of said chamber located nearest to the door 8. From this part of the distillation chamber leads a pipe 10 for drawing off such gases of distillation which are to be removed from the furnace and conducted to a condenser or to another furnace. A pipe 11 leads to the heat chamber for supplying steam during such periods of the distillation process when steam may be required.

In the embodiment illustrated the heat radiators 3 in the heat chamber consist of a single pipe bent in zig-zag shape through which pipe gases of combustion flow from one end to the other of the chamber in the direction indicated by the arrows 12 in Fig. 1. The gases of distillation flow through the heat chamber in the direction indicated by the arrows 13 in Fig. 2. In place of such heat radiators, through which gases of combustion flow, electric heaters may also be used, if desired.

The trucks 9 consist of sheet metal boxes having a square cross section and supported on wheels, said boxes being open at both ends but otherwise closed all around. Said boxes are divided by means of intermediate bottoms 14 equally spaced one above the other into a number of floors each of which forms a horizontal passage having comparatively large width but small height. The floors, however, need not necessarily have the same width as the trucks, but said trucks may be divided if desired, into two halves by means of a vertical partition extending in the longitudinal direction of the truck. It is important, however, that the different floors are on the same level in all trucks, so that when the trucks are placed one against the other in a row in the manner shown in Fig. 1, the floors form continuous horizontal passages throughout the entire row of trucks. The rear opening of the distillation chamber 1, which opening communicates through a conically tapering part 15 with the fan 5, is arranged in such manner that the innermost truck of the row may be tightly connected with the same, so that the gases flowing from the heat chamber 2 are forced directly into the passages formed by the floors of the trucks. In the part 15 there are provided a number of partitions 16 which serve to distribute the gases into said different passages after the gases have become mixed immediately before by the fan 5.

The mass to be dry distilled being spread in liquid state on the bottoms 14 and being, moreover, still liquid also during the first part of the distillation, the bottoms are provided at one or both of the open ends of each truck with inclined edges 17 or flaps to be let down which may have a height of 3 to 6 centimeters depending upon the thickness of the layer of substance. If thin layers are used it is sufficient to use stationary edges inclined upwards and outwards, see Fig. 1, so that the residue of distillation, which owing to contraction during the process lies loose on the bottoms, may be easily removed by lifting up one end of the truck until the residue of distillation falls out. If thick layers of the substance are desired the edges 17 are preferably made as flaps to be let down, so that there is no obstacle to removing the residue of distillation from the bottoms. In this latter instance, however, the edges must be tightened before each new filling with liquid substance, such tightening being preferably made by means of mortar.

In order to avoid leakage between the different trucks of the row, the trucks are preferably provided with screw joints or similar couplings by means of which they may be tightly connected to one another at the ends. Tightness between the innermost truck of the row and the rear opening of the distillation chamber may be obtained by the row of trucks being pushed against said opening and locked by placing blocks under the wheels. It will be understood, however, that screw couplings may be used also at this place.

The operation of the furnace described will be clearly understood from the above description and from the drawing. The gases are forced by the fan 5 to circulate through the heat chamber and through the trucks in the distillation chamber in the direction indicated by the arrows 13 in Fig. 2, thereby absorbing heat from the heat radiators 3 and again giving off said heat to the mass to be dry distilled. In this manner it is possible to heat uniformly the mass to the comparatively low temperatures, 500° C. at the most, required for carrying out the process.

We claim:

1. In a furnace for dry distillation of waste liquor and similar masses, the combi-

nation of a heat chamber, heating elements in said heat chamber, a distillation chamber communicating at both ends with said heat chamber, trucks in said distillation chamber having a number of floors for receiving the material to be distilled, said trucks being adapted to be connected to one another in a row in such manner that said floors form continuous horizontal passages through said row of trucks, and means for effecting circulation of gases in said chambers and through said passages in said row of trucks.

2. In a furnace for dry distillation of waste liquor and similar masses, the combination of a heat chamber, heating elements in said heat chamber, a distillation chamber communicating at both ends with said heat chamber, trucks in said distillation chamber having a number of floors for receiving the material to be distilled, said trucks being adapted to be connected to one another in a row in such manner that said floors form continuous horizontal passages through said row of trucks, and means for effecting circulation of gases in said chambers and through said passages in said row of trucks, said distillation chamber having at one end an opening for introducing and removing said trucks and having at its other end an opening to the heat chamber arranged in such manner that an adjacent truck may be tightly connected to said opening so that gases from the heat chamber may be forced directly into said passages in said row of trucks.

3. In a furnace for dry distillation of waste liquor and similar masses, the combination of a heat chamber, heating elements in said heat chamber, a distillation chamber communicating at both ends with said heat chamber, trucks in said distillation chamber having a number of floors for receiving the material to be distilled, said trucks being adapted to be connected to one another in a row in such manner that said floors form continuous horizontal passages through said row of trucks, means for effecting circulation of gases in said chambers and through said passages in said row of trucks, said distillation chamber having at one end an opening for introducing and removing said trucks and having at its other end an opening to the heat chamber arranged in such manner that an adjacent truck may be tightly connected to said opening so that gases from the heat chamber may be forced directly into said passages in said row of trucks, and partitions in said second opening serving to distribute the gases from the heat chamber into said passages in said row of trucks.

4. In a furnace for dry distillation of waste liquor and similar masses, the combination of a heat chamber, heating elements in said heat chamber, a distillation chamber communicating at both ends with said heat chamber, trucks in said distillation chamber having a number of floors for receiving the material to be distilled, said trucks being adapted to be connected to one another in a row in such manner that said floors form continuous horizontal passages through said row of trucks, said distillation chamber having at one end an opening for introducing and removing said trucks and having at its other end an opening to the heat chamber arranged in such manner that an adjacent truck may be tightly connected to said opening so that gases from the heat chamber may be forced directly into said passages in said row of trucks, partitions in said second opening serving to distribute the gases from the heat chamber into the passages in said row of trucks, and a fan located adjacent said partitions and serving to force the gases from the heat chamber through said second opening between said partitions and into said passages in said row of trucks.

5. In a furnace for dry distillation of waste liquor and similar masses, the combination of a heat chamber, heating elements in said heat chamber, a distillation chamber communicating at both ends with said heat chamber, trucks in said distillation chamber having open ends and a number of floors with inclined edges at least at one end of each truck, said trucks being adapted to be connected to one another in a row in such manner that said floors form continuous horizontal passages through said row of trucks, and means for effecting circulation of gases in said chambers and through said passages in said row of trucks.

6. In a furnace for dry distillation of waste liquor and similar masses, the combination of a heat chamber, heating elements in said heat chamber, a distillation chamber communicating at both ends with said heat chamber, trucks in said distillation chamber having a number of floors for receiving the material to be distilled, said trucks being provided with means for tightly connecting the same to one another end to end in a row in such manner that said floors form continuous horizontal passages through said row of trucks, and means for effecting circulation of gases in said chambers and through said passages in said row of trucks.

ERIK LUDVIG RINMAN.
GUNNAR FREDRIK MAGNUSON.