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P. OSTERTAG.

DRYING STOVE.

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Fig. 1

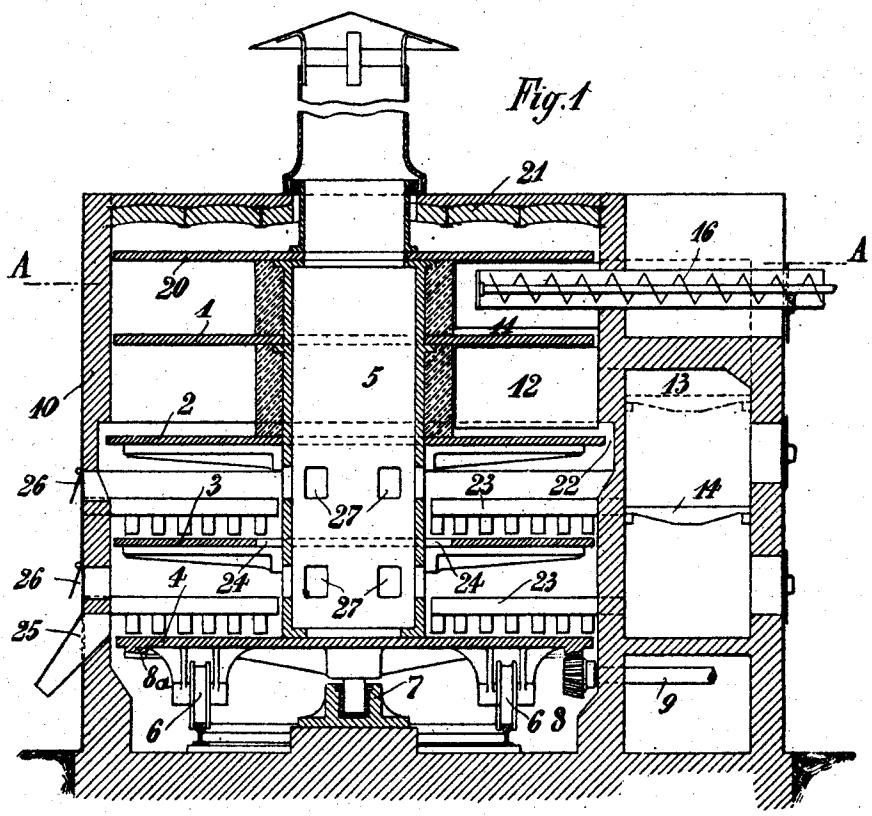
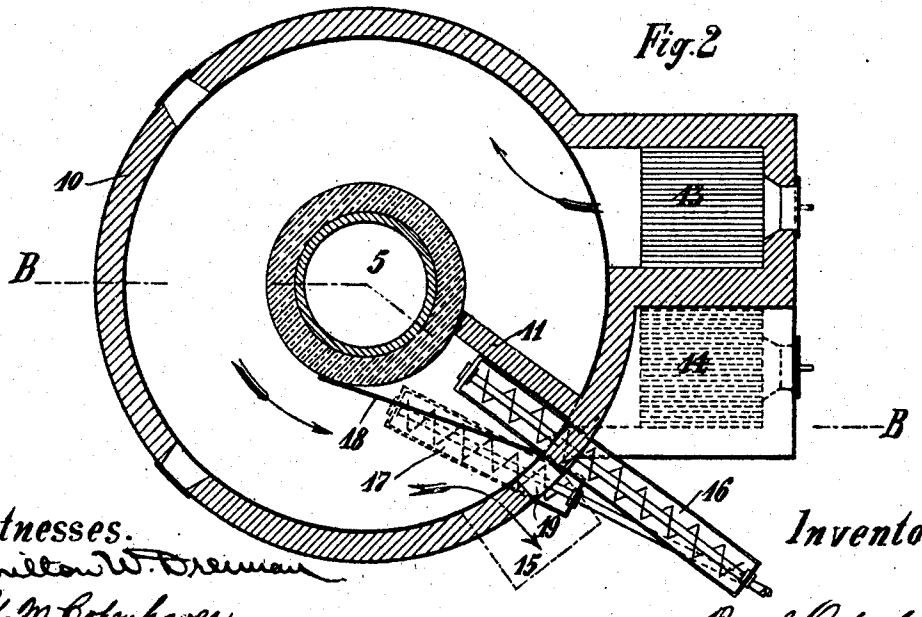



Fig. 2




Witnesses.

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## DRYING-STOVE.

No. 864,186. Specification of Letters Patent. Patented Aug. 27, 1907.

Application filed April 22, 1907. Serial No. 369,606.

*To all whom it may concern:*

Be it known that I, PAUL OSTERTAG, a citizen of Switzerland, residing at Winterthur, in the canton of Zurich, Switzerland, have invented certain new and useful Improvements in Drying-Stoves; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The subject-matter of the present application is an improved drying-stove of the multiple-story type for drying coal and other material which while in a wet condition is able to stand considerable heat, but to which as the drying operation advances only slight warmth should be supplied if the ignition of the material is to be avoided.

The new stove is built after the manner of the well-known stoves of the multiple-story type, that is, it possesses several floors in the form of trays or plates which are arranged one above another and are carried by a rotating central hollow shaft together with which the floors slowly rotate. The material to be dried is brought on to said floors in succession which lead it round in the stove which incloses them and thus bring it into contact with the drying medium.

Now the object of the present invention is to render stoves of the above-described type applicable to the drying of the materials mentioned above particularly by forming each of the upper drying-chambers or stoving-chambers containing the wetter portions of the material to be dried as a closed channel in which a fixed radial partition-wall reaching from the outer wall of the stove up to the hollow shaft is arranged, and by not only the material to be dried but also the drying-medium for each stoving-chamber being introduced separately into said channels, so that the drying medium is compelled to traverse these annular stoving-chambers up to the outlet situated at the other side of the partition wall in the direction of rotation of the floors, that is, in the same direction as that in which the material to be dried lying on said floors moves, and so that, while the freshly delivered wet material for the time being is heated most in these upper stoving-chambers, the lower stoving chambers, into which the material does not pass until it has been almost completely dried, are in communication with the outer air through holes in the stove wall and with the interior of the shaft carrying the floors through holes in the periphery of said shaft, the result of which is that fresh cold air can be led through the lower chambers for the purpose of cooling the material undergoing treatment.

One form of the drying-stove constructed according to this invention is illustrated by way of example, in the accompanying drawing, in which:

Figure 1 is a vertical section on the line B—B Fig. 2, and Fig. 2 is a horizontal section on the line A—A Fig. 1.

The stove illustrated possesses by way of example, four circular floors 1, 2, 3, 4, which are situated one above another and are fitted in the stove together with a central hollow cylinder or shaft 5, with which they can be set in slow rotation. The whole rotating portion of the stove rests on rollers 6, the bearing 7 serving merely for centering said portion. This rotating portion is driven from the shaft 9 through the gearings 8, $8^a$.

Of the four floors the two upper ones 1 and 2 serve for the drying operation, while the others serve for cooling the dried material, which is led round in the annular chamber formed on each story between the inner hollow cylinder 5 and the outer stove-wall 10. In the stories above the floors 1 and 2 the cylinder 5 is covered with fire-proof material. At one place on each of said stories a partition wall 11 or 12 crossing the annular chamber projects from the outer wall towards the cylinder. The two supplies of furnace gases utilized for the drying operation in the chambers above the heated floors 1, 2 are produced separately in the fire-chambers 13 and 14 respectively situated near the stove and are introduced directly in front of the partition-walls 11 or 12 into the respective stoving-chambers. The furnace-gases consequently pass in these annular chambers over the floors and entirely round the cylinder 5 to the outlet flue 15 (Fig. 2) behind the partition-wall. The floors also are driven in the same direction of rotation. Spiral conveyances 16, 17 which project from outside into the stove serve for feeding the material to these floors 1, 2 respectively, said conveyances delivering the material uniformly on to the floors behind the walls 11, 12 and distributing it thereon in such a manner that said floors are always covered with a layer of a thickness as uniform as possible. The walls do not project down quite as far as the floors so that the material delivered by the conveyers is carried away under them when the floors rotate, the walls at the same time serving to scrape level the upper surface of the layer of material being fed in. In this manner the closure between the walls 11, 12 and the floors 1, 2 is sufficiently perfect during the operation of the stove to prevent the furnace gases from escaping under the walls into the outlet-flue 15. The material on these two plates 1, 2 is dried by the wet material being fed by the conveyer 16 on to the upper floor 1 together with which it travels round once. Immediately after the material has been delivered it is played upon by the hot furnace-gases coming from the grate in the fire-chamber 13, which gases continuing their course sweep continuously over the material always delivering up their greatest heat

to fresh material. The supply of heat to the latter is consequently continually less in correspondence with the advancing state of the drying operation the further it has traveled round the cylinder 5. The material which has made one revolution on the floor 1 and which is consequently half dried, is conveyed outwards shortly before it arrives back at the point of delivery by means of an obliquely placed scraper 18, which is, *per se* of the well-known kind, and passes through an opening 19 in the wall of the stove into the conveyer 17 situated below, by which it is delivered on to the second floor 2 on which it is again treated in the same manner as before with the exception that the drying-medium for this second portion of the drying operation is produced on the grate in the fire-chamber 14 in a less quantity, and in one which can be exactly regulated, so that if desired the supply of heat may take place according to requirement simultaneously with the supply of cold air, the result being that the ignition of the material during this phase of the drying operation can be readily avoided.

The uppermost stoving chambers which is above the floor 1 is closed above by means of a plate or floor 20 which is similar to the other floors and likewise rotates. Said floor 20 is intended to prevent the heat from escaping and the uppermost stoving-chamber from cooling down on account of the effect of the outer air on the stove-vault. At the same time it stores up in itself a part of the intense heat in the neighborhood of the place where the furnace-gases for the top stoving-chamber enter the stove and carries it forward during its rotation. This has the advantage that the temperature in the neighborhood of said place does not become too high. In order to increase the capacity of said floor to store up heat, it may be covered with stones. Another advantage of this arrangement consists in the roof proper 21 of the stove being able to be supported in a simple manner by means of I-beams, an expensive vault being unnecessary. Moreover the layer of air over this floor 20 reduces loss of heat by conduction. In a manner similar to that in which heat is supplied to the floor 20 it is also supplied from below to the floor 1 by means of the furnace-gases in the second stoving-chambers which heat supplied to said floor 1 is also turned to good account by heating the material resting on said floor. All these features lead to the material in the uppermost stoving chamber being subjected to the greatest heat.

The material might be completely dried in the above-described manner if desired on more than two floors or on only one floor. After being completely dried it is conveyed from the last stoving-floor 2 on to the other floors situated thereunder, for example, in the case illustrated on to the two floors 3, 4 in order to be cooled down on these. From the floor 2 it is led to the floor 3 by being conveyed to the edge of 2 by means of obliquely placed blades or by means of a scraper, or the like, as in the case of the floor 1, from which edge it falls on to the floor 3 through a recess 22 in the stove-wall. On said floor 3 it is pushed from the edge towards the center by means of stirring-arms 23 fixed in the wall and provided with blades set obliquely to a suitable degree. On reaching the center it falls through openings 24 in the floor on to the next lower floor 4 on which it is conveyed in a similar manner by means of stirring-arms 23 from the center towards the edge where it passes out of the stove through one or more openings 25. This method of conveying the material on the floors 3, 4 is known *per se*. While traveling over these two floors 3, 4 the material is cooled by a current of air entering into the chambers above these floors through adjustable openings 26 in the stove-wall which current of air passes through openings 27 in the periphery of the hollow cylinder 5 into the latter and out into the atmosphere.

Having now explained the nature of my invention I declare that what I claim and desire to secure by Letters Patent is:

1. In a multiple-story drying stove in combination with a central hollow shaft 5 trays or floors 1, 2, 3, 4 turning round with said shaft, a shaft 9 and gearings 8, $8^a$ for turning said shaft 5 and trays 1, 2, 3, 4 rollers 6, a bearing 7 carrying said rotating shaft 5 and trays 1, 2, 3, 4, a wall 10 surrounding said revolving shaft and trays, partition walls 11, 12 respectively connected to said wall 10 and reaching into the chambers formed above the plates 1, 2 respectively, scrapers 23 held rigidly in the wall 10 and reaching into the spaces above the plates 3, 4 respectively, the whole as described and illustrated and for the purpose set forth.

2. In drying mechanism, a central shaft and a vertical series of trays attached thereto, in combination with means for rotating said shaft and trays, a wall surrounding said trays, feeding devices supplying the upper tray, outlet passages from each tray, a conveyer from the first tray to the second, a scraper arranged to direct the partly dried material from the first tray through its outlet to the said conveyer, and stirring arms which direct such material to the outlets of the third and fourth trays substantially as set forth.

3. In drying mechanism, a central shaft and a vertical series of trays attached thereto, in combination with partitions dividing the spaces above the first and second trays, means for supplying furnace gases to said spaces in proximity to said partitions, a passage for the material downward from one tray to another, means for rotating the shaft, and trays and means for cooling the lower two trays for the purpose set forth.

4. In drying mechanism, a hollow central shaft a series of trays carried thereby, a passage for the material acted on from tray to tray downward, means for supplying a heated drying medium to the upper tray and means for rotating the said shaft and trays, the said shaft having its wall perforated to supply cool air to the lower part of the series of trays substantially as set forth.

5. In drying mechanism, an inclosed rotating shaft and vertical series of trays, in combination with means for supplying a heated fluid drying agent to the upper part of said series, means for supplying a cooling fluid to the lower part of said series and means for directing the material to descend in a spiral path from story to story of the apparatus substantially as set forth.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

PAUL OSTERTAG.

Witnesses:
R. BRAUMANN,
H. STOESSEL.