

June 26, 1928.

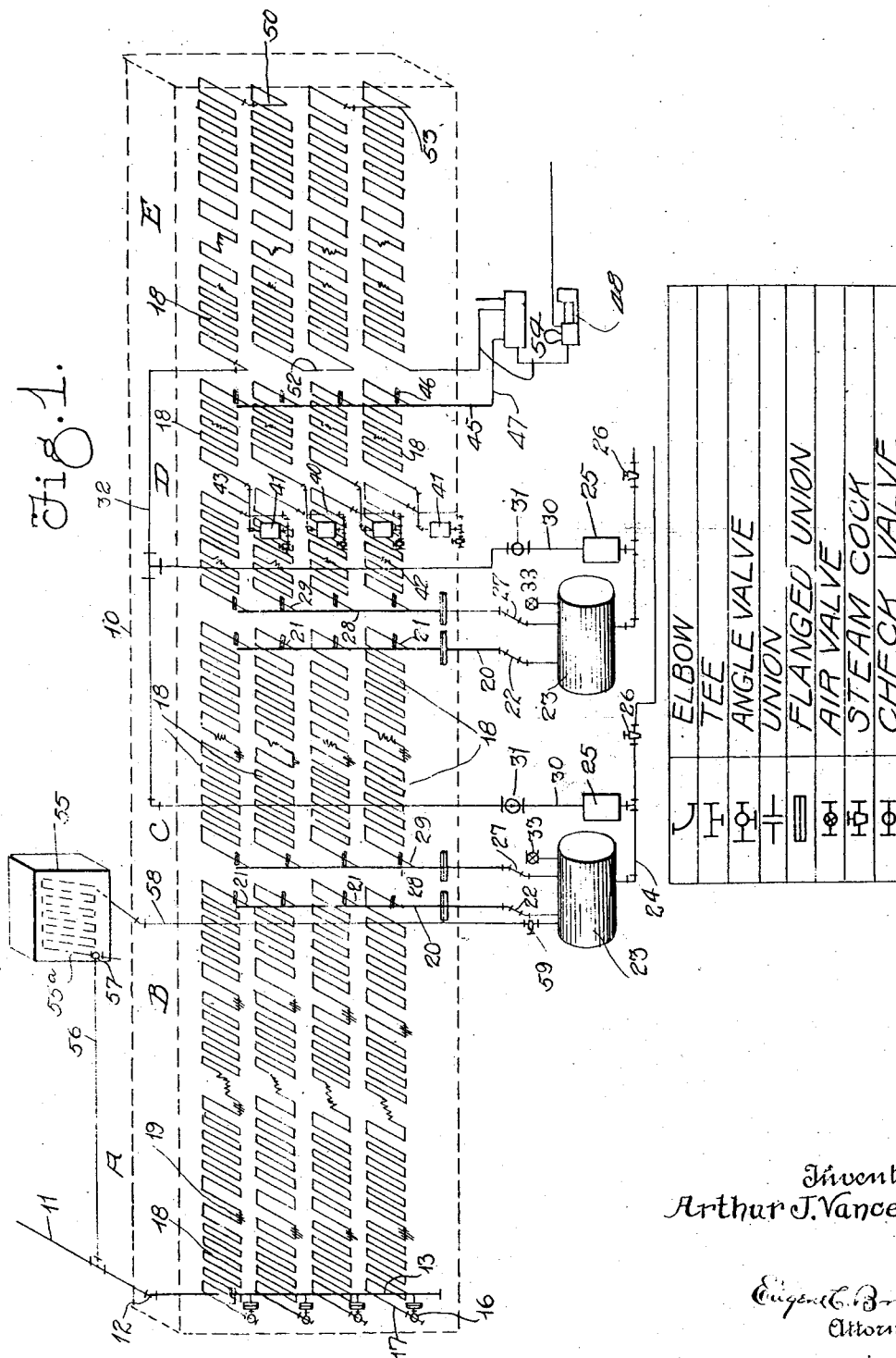
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DRIER FOR VENEER AND SHEET MATERIAL

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6 Sheets-Sheet 1



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Fig. 3.

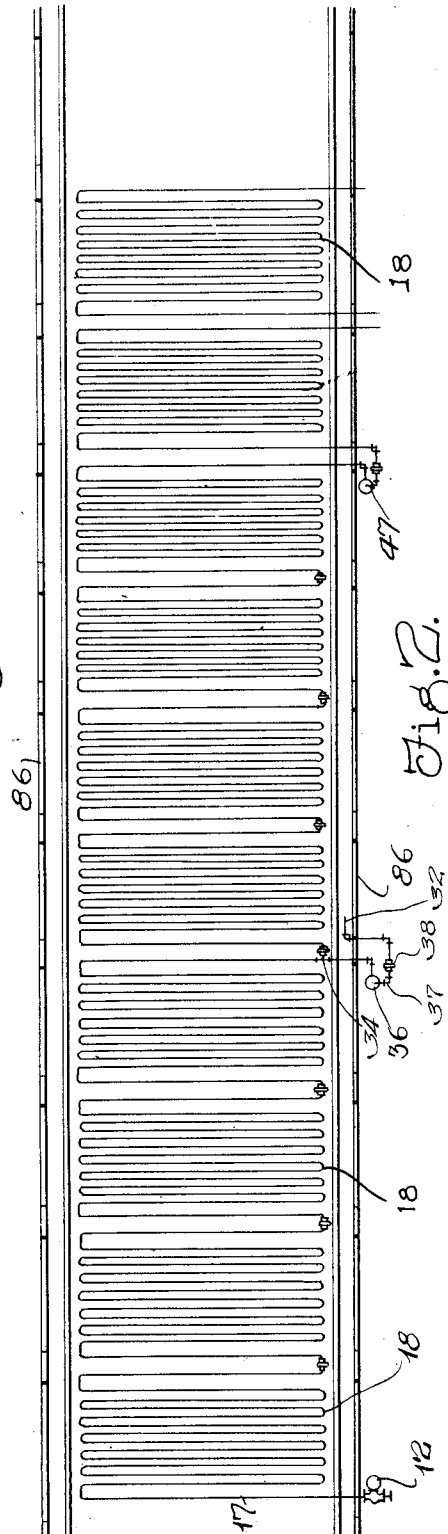
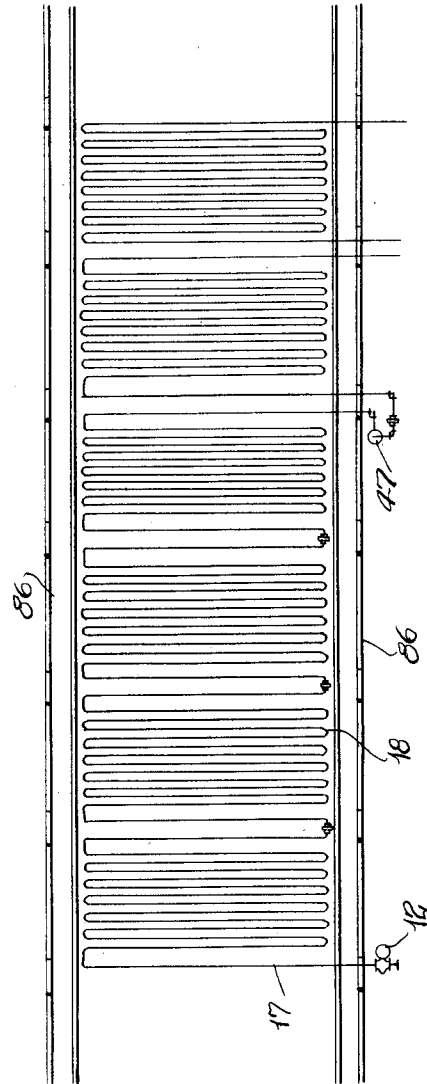


Fig. 2.



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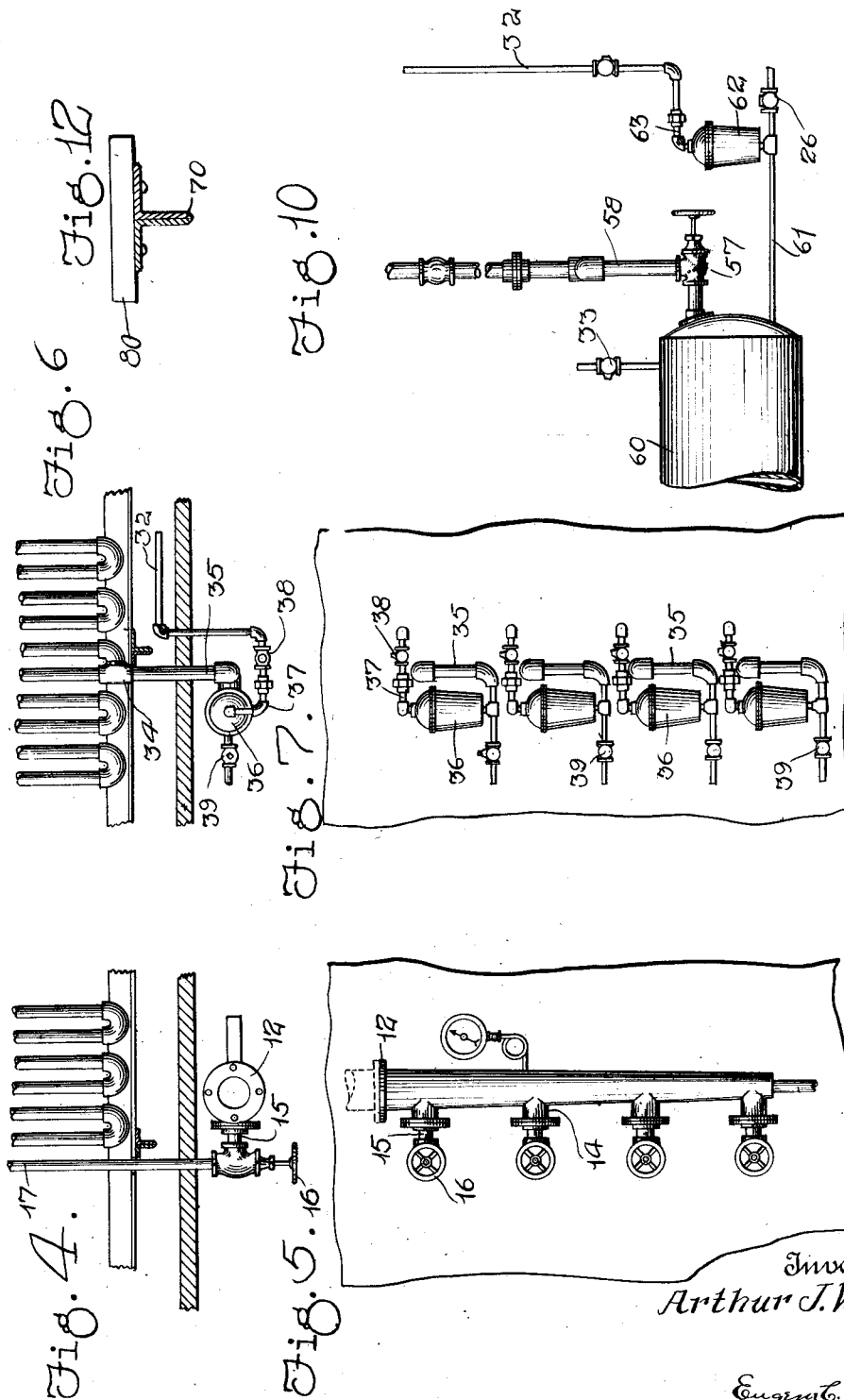
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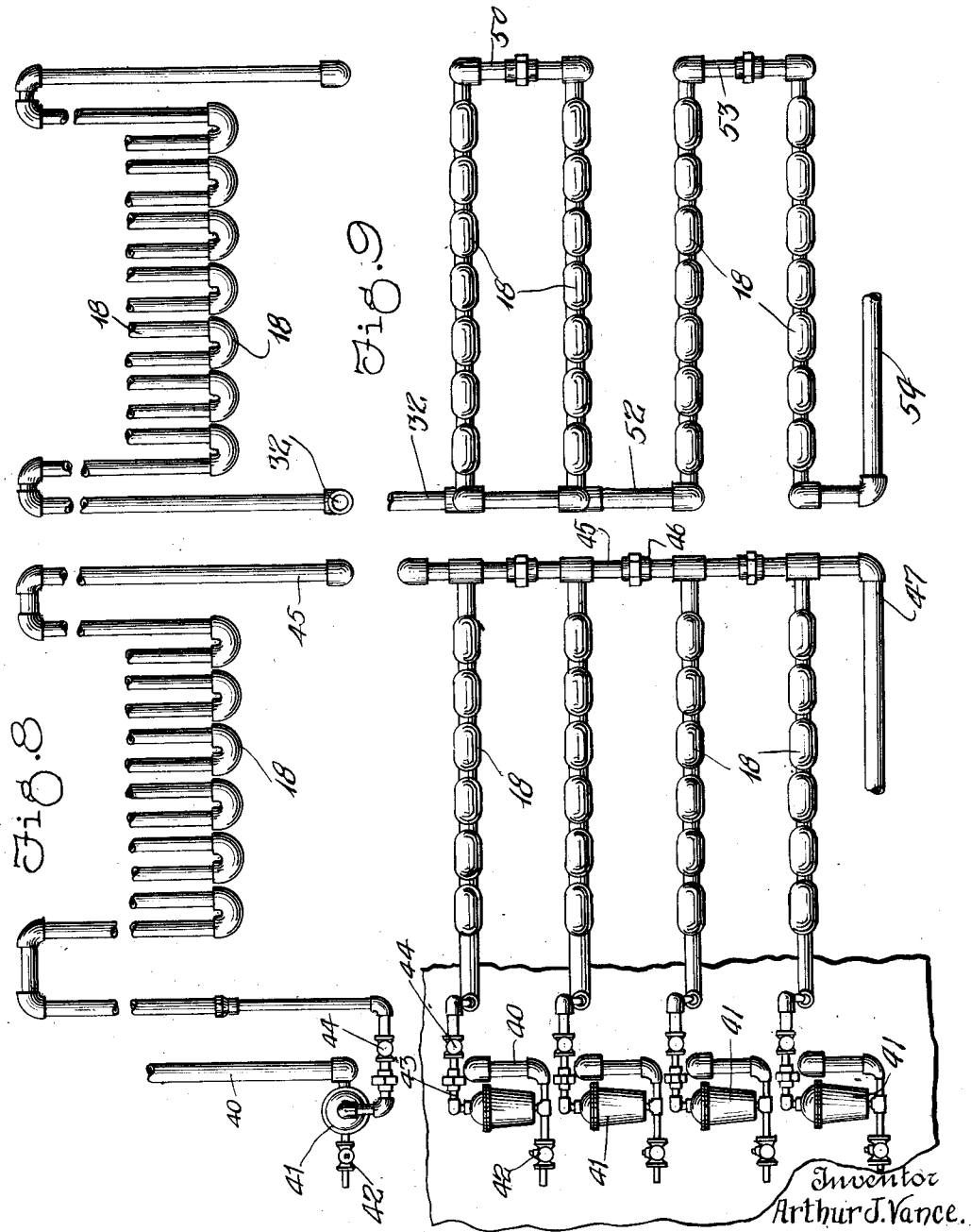
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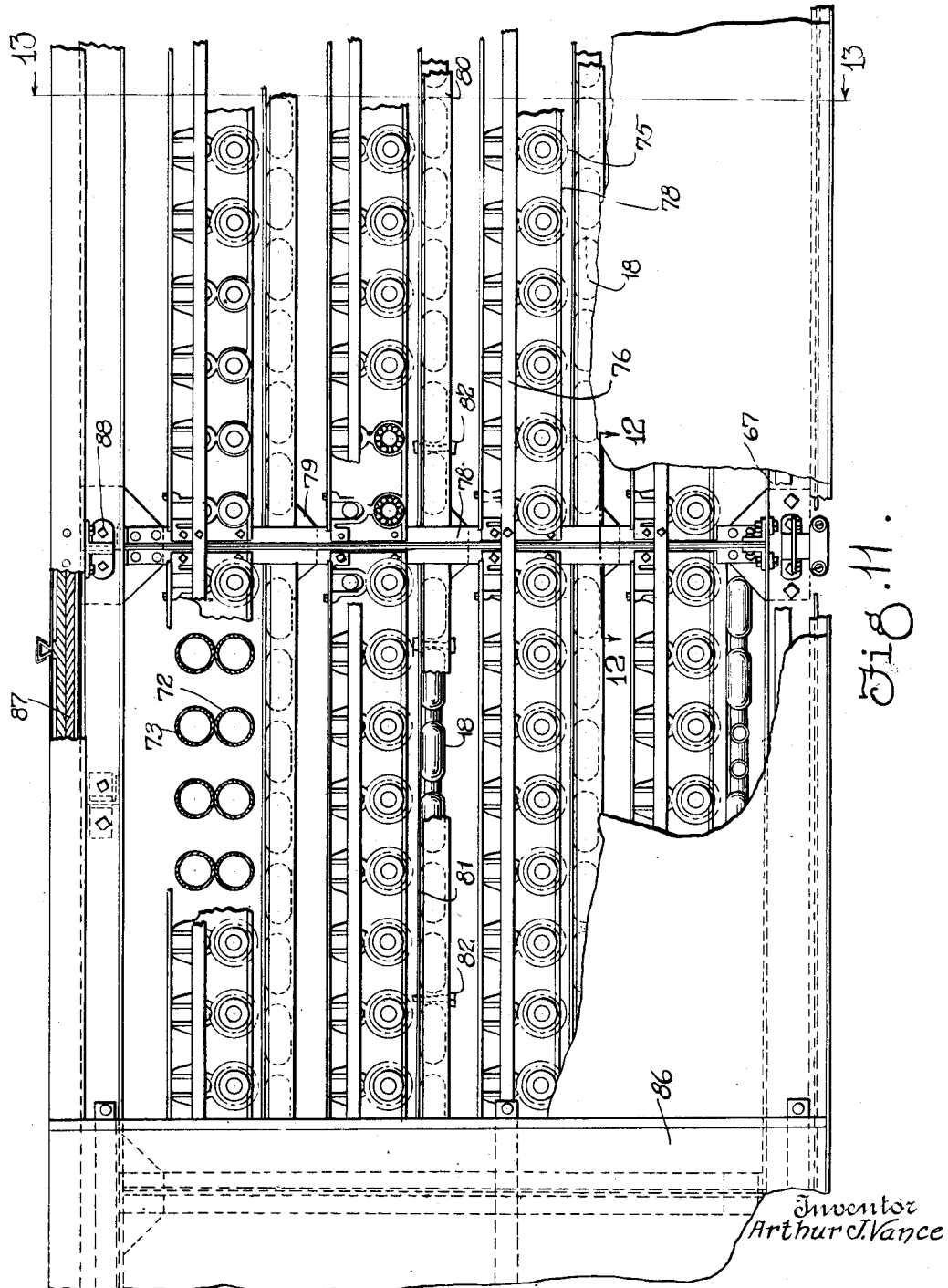
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6 Sheets-Sheet 5



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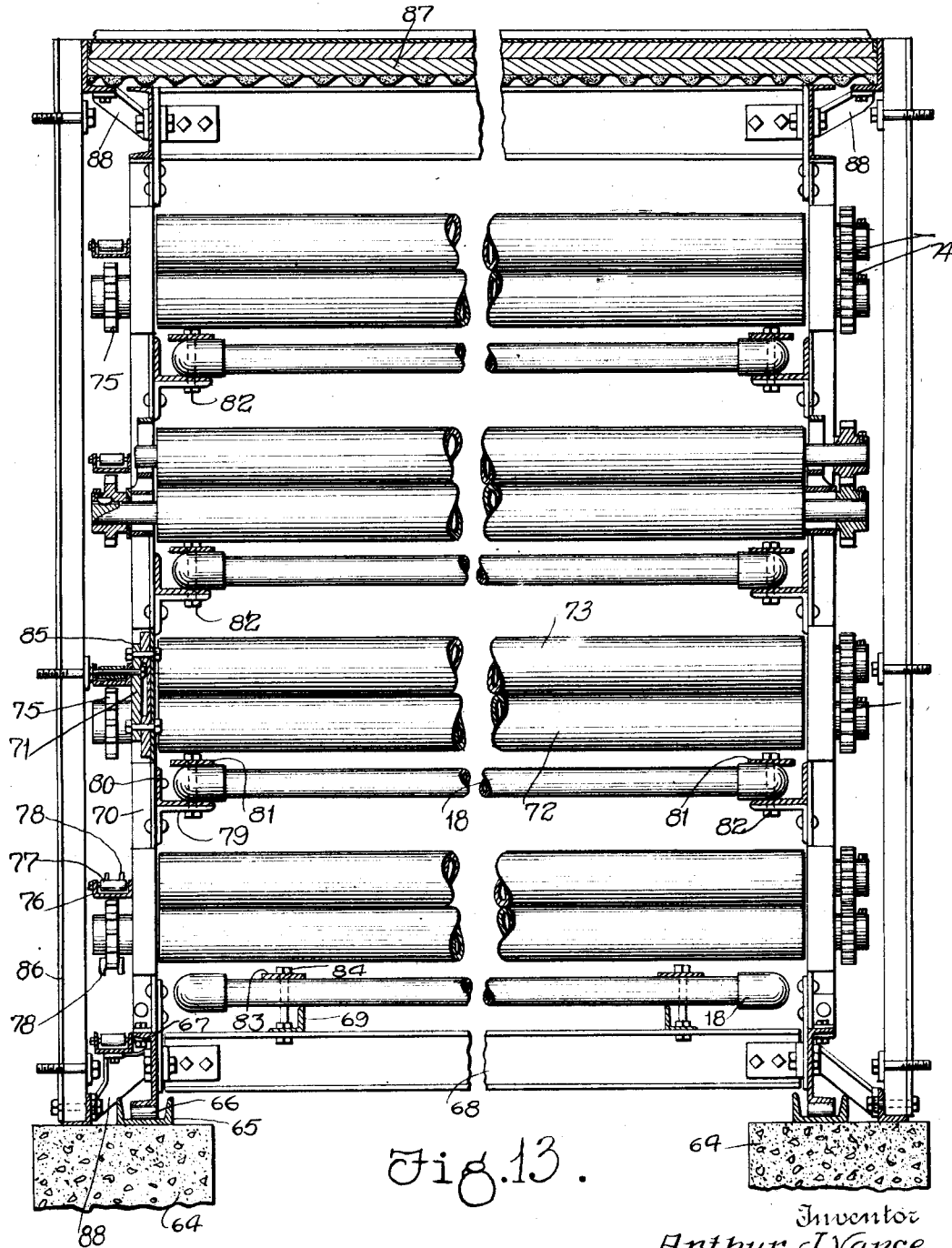
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DRIER FOR VENEER AND SHEET MATERIAL

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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE.

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DRIER FOR VENEER AND SHEET MATERIAL.

Application filed August 1, 1924. Serial No. 729,616.

This invention relates to driers of the progressive type wherein sheet material is passed at a suitable speed through a long chamber wherein means are employed for moving the sheet and which is heated and ventilated in a suitable manner, such devices being frequently employed for the drying of veneers and wall board and other like material.

In veneer driers of this general class the long chamber is frequently heated by horizontal steam coils or radiators which extend from end to end of the long chamber, the coil sections running transversely of such chamber. Since these chambers are commonly of very considerable length, sometimes running into hundreds of feet, much condensation of the steam in the coils is experienced. It is frequently desirable to use temperatures considerable in excess of 212 degrees Fahrenheit and to obtain these temperatures high pressure steam is employed. If the condensate be trapped off the temperature of the condensate, under such circumstances, will commonly be much above the normal or atmospheric boiling point of 212 degrees Fahrenheit. Consequently such condensate will contain a large portion of utilizable heat units. Again, apparatus of this character, employs horizontal sets of feeding rollers with the horizontal steam coils between them. Economy in the use of heat and in space dictates that the vertical distance between the steam coils and the feeding rolls should be kept low. Also, it is necessary, in order to facilitate repairs, that sections of the steam coils should be readily removable as units.

Among the important objects of the present invention are the improvement of the steam distribution and coil arrangement in such manner as to effectively utilize the heat of high pressure steam; to prevent or minimizing loss of heat in condensate; to provide means for withdrawing condensate at points along the length of the apparatus and re-utilizing the same by permitting the water to flash into steam in a succeeding section of the heating coil or to circulate therethrough as condensate; and to provide means whereby the heating coils are so assembled that sections of such coils may be removed without difficulty for repairs or replacement.

With the above and other objects in view,

as will be hereinafter apparent, one typical form of the invention will now be described in detail and hereinafter specifically claimed, reference being had to the accompanying drawings, wherein:—

Figure 1 is a diagrammatic view of the piping arrangement for such a veneer drier.

Figure 2 is a plan diagram of the piping arrangement for a drier of this type as suitable for the shorter sizes, the diagram showing a modified arrangement for handling condensation.

Figure 3 is a plan similar to Figure 2 but showing the arrangement for a longer drier.

Figure 4 is a plan of the steam supply connections at the dry or delivery end of the drier.

Figure 5 is a side elevation thereof.

Figure 6 is a plan of certain bleeder trap connections used at intervals between ends of the drier.

Figure 7 is an elevation of the same.

Figure 8 is a plan view of the arrangement at the wet end of the drier showing the return trap and condenser coil connections.

Figure 9 is an elevation thereof.

Figure 10 is an elevation showing certain steam and return connections which are used at the coils employed for heating air passing through the drier.

Figure 11 is a side elevation of the mechanisms within the drier, the same being partly in elevation and partly in section.

Figure 12 is a detail section on the line 12—12 of Figure 11.

Figure 13 is a vertical section on the line 13—13 of Figure 11.

In the diagrammatic view of the steam piping disclosed in Figure 1 the pipes are indicated by single lines with conventional pipe diagram symbols, a table thereof being appended to the figure. In this figure the outline of the conveyer casing is diagrammatically indicated by a dotted line 10 and it will be seen that this outline is, in the present instance, divided into five groups of sections which are indicated respectively at A, B, C, D and E. The group A is at the dry or delivery end of the drier while the group E is at the wet or feeding end thereof, that is to say that the material to be treated is fed in through the group E and passes out through the group A. As will be explained hereinafter, the material passes

over the tops of the several sets of coils, the coils being here shown as four high.

While the material passes from E in the direction just stated the steam is introduced at the dry end and works through the coils in a direction opposite to that wherein the material being treated moves. The sets or groups of coils A, B, C and the first section of group D are those sets wherein live steam is employed while the second section of group D and group E are the sets wherein condensate is used, the first groups being known as steam groups and the last as condenser groups.

It is obvious that the number of groups or sections employed will vary with the size of the drier and that the ratio between the number of steam groups and the number of condenser groups may also be varied to suit the different conditions arising in the special drying problem to be met.

The steam for the device is provided through a suitable steam pipe 11 and this pipe is connected by a flange coupling 12 with a header 13. As shown best in Figure 5 this header tapers from its upper end downward and is provided at intervals with branches 14 which are connected by nipples 15 to controlling valves 16. Each of these valves controls the admission of steam to a respective horizontal line of heater coils, the valve being connected to the initial section of such lines by a supply pipe 17. Each steam line or each group consists of a series of sections 18 each forming a heater unit, the sections being connected to each other by suitable unions 19 so that any section can be detached from the adjacent sections for repairs and replacements.

At the ends of groups B and C suitable means are used for drawing off the condensate which has accumulated in the group and supplying the next succeeding steam section with steam. In the form of the invention shown in Figure 1 there is provided at the outlet end of each group a header 20 having branches 21 to which the several end sections of the group are connected. This header is in turn connected by a pipe 22 with a collecting tank 23 provided with a condensate pipe 24 leading from the bottom of the tank to the steam trap 25 which functions to prevent the passage of steam but permits the passage of the condensate. A blow-off valve 26 is also connected to the pipe 24 to permit discharge to the atmosphere for cleaning out purposes. From the collecting tank extends a pipe 27 which is connected to a steam header 28 having branches 29 connected to the initial sections 18 of the succeeding steam group. From the traps 25 extend condensate lines 30 provided with check valves 31 opening away from the traps and these pipes are in turn connected to a common feed pipe 32 leading to the initial

heater section 18 of the upper line of group E. Also, the separator tanks 23 are provided with air valves 33 so that they may be freed from accumulated air. Thus the steam groups are connected so that the steam passes through the groups serially, the condensate being removed at the end of each group.

A modification of this arrangement may also be used as shown in Figures 3, 6, and 7. In this modification each steam line runs continuously through the several steam groups, the line being divided into sections as before. At the end of each group a T connection 34 is provided and from this connection extends a drain pipe 35 which leads to a steam trap 36, there thus being a separate trap for each steam line, as can readily be seen by reference to Figure 7. From the several traps lead condensate pipes 37 provided with check valves 38 and these pipes are extended and connected to the condenser section just as were the pipes 30. The usual blow-off valve 39 is provided for each trap.

It will be observed that the tanks 23 in Fig. 1 collect the condensate, the steam passing on through the headers 28 to the intake ends of the coils in sections C and D, while the condensate passes back through the common pipe 32 to the intake end of the first coil in section E.

The arrangement of the groups in section D is somewhat different, as appears from Fig. 1 and the detail views shown in Figs. 8 and 9. The first series of coils in section D is supplied with steam from the header 28 leading from tank 23. The outlet end of each of these coils is connected through a short pipe 40 with a steam trap 41, which is provided with the usual blow-off valve 42. From each of these traps the condensate passes through a pipe 43, having a check valve 44, to the inlet end of the first condenser coils, constituting the second series or group of coils in section D. Thus, at this point in the apparatus the condensate for the condenser group of section D passes through the traps 41 while previously the flow of steam from one group to another was directly through the separator tanks, the condensate being simply drawn off at said tanks. The arrangement shown in Figures 6 and 7 has been termed a "bleeder trap" arrangement while the arrangement just described is known as a "return trap" arrangement. The various sections at the other terminal of the first condenser group are connected in common to a header 45, unions 46 being arranged in the header so that the sections in the various lines may be separated, and this header is connected by a pipe 47 to the receiver of a pump 48, which is vented to the atmosphere, so that no appreciable pressure can be built up in the condenser coils.

As previously described, the condensate pipe line 32 connects with the initial section 18 of the top heater line of the second condenser group. The terminal section of this top line connects with the corresponding section of the second line by a pipe 50. The second line is similarly connected by a pipe 52 with the third line and the latter by a pipe 53 with the fourth line being connected by a pipe 54 with the receiver of the pump 48. An open tank or other hot water receptacle can be used for collecting the hot water. If an automatic pump and receiver is used, the hot water may be automatically returned to the boiler while hot. The receiver of the pump being vented to the atmosphere to prevent the building up of pressure in the condenser coils, and the condensate that enters the inlet end of the coils being water at a temperature more than 100° Fahr. above atmosphere boiling point, this condensate will immediately expand and flash into low pressure steam in the condenser coils. In other words, with high pressure steam flowing through the group A, water will be removed at intervals and this condensed water will be at substantially the same temperature as the steam at the point of its removal so that whenever the pressure is lower, as in the condenser groups, this water of condensation flashes back into steam at a somewhat lower temperature than the steam at the first steam group. The pump is connected by pipe 45 with the outlet ends of the second group of coils in section D and with the outlet end of the series-connected coils in section E to maintain the pressure in these coils sufficiently low to cause the condensate to flow through the pipes 32 and 43 into the condensate groups of coils where it flashes into low pressure steam as previously stated. Experience has shown that, under usual conditions, steam may conveniently be provided at a temperature of about 348 degrees, and that under these conditions the final condensate water will have a temperature of about 235 degrees. By thus transforming the condensate from a liquid state into a gaseous vapor or steam, the molecular activity is vastly increased, as is well-known, and I am thereby enabled to abstract a far greater amount of heat energy than could be obtained from the liquid condensate at the same or even a higher temperature. At the pressure and temperature which I have employed in practice, I am enabled to save substantially one hundred B. t. u.'s per pound of condensate.

If an apparatus of this kind it is usual to provide for the drying effect a circulation of hot air through the drying chamber. It is common to use a fan or other blower arranged to cause such circulation, the air passing through an air heating chamber

provided with steam coils. This feature being clearly disclosed in my copending application, Serial No. 729,618, filed August 1, 1924, it is not deemed necessary to show the fan and other parts herein but there has been indicated at 55 an air heating chamber having steam coils 55^a to which a supply pipe 56 leads from the main 11, being controlled by the valve 57. From this heating chamber leads a steam exhaust pipe 58 connected to one of the separator tanks 23 as shown in Figure 1. However, a slight modification of this arrangement may be made as shown in Figure 10. In this figure the header of the air heating coils to which the pipe 56 is connected is shown at 60 and from this header a drain pipe 61 leads to a steam trap 62 which is connected by a pipe 63 leading to the condenser line 32. Thus the condensate, in either case, from the heater coils is conducted to the second condenser group.

We will now consider the construction whereby the heater sections are supported so they can be removed with ease. This construction is shown in general in Figures 11 and 13 and it will be there seen that on foundations 64 there are supported guiding channels 65 wherein are rollers 66 on which rests the channels 67 forming the main longitudinal sill of the device. It is to be noted that provision of this sort is made in order to allow for expansion and contraction under changing temperature conditions. The sills 67 are tied together at intervals by cross sills 68 and on these cross sills are supported the longitudinal angle irons 69 forming coil bearers whereon the coil sections 18 rest. Similarly, at like intervals, the sills 67 support vertical frame members 70 each formed of a pair of angle irons. These frame members support longitudinally extending roller bearing bars 71 wherein are journaled the lower rollers 72 and the upper rollers 73. These rollers are arranged in pairs, one above the other, and are connected at one end by suitable gearing 74 while at the other end the lower roller of each pair is provided with a sprocket 75. Channels 76 extend longitudinally of the outside of the frame members 70 and support idler rolls 77 whereon may rest the slack side of a sprocket chain 78 driven by suitable means and engaging the sprockets 75 to drive the rolls of the particular line engaged, it being understood that separate chains are provided for each line. On the vertical members 70 is provided a series of angle iron brackets 79 arranged in opposite pairs between vertically spaced sets of rollers, the brackets on each side being in horizontal alinement. Extending between adjacent frame members 70 are angle irons 80 forming bearers for the steam coil sections 18, these bearers being of such length

that they may be slid out between the frame members 70. Now it will be noticed that the sections 18 are supported close beneath the several lines of bottom rolls 72 so that, if means are not provided to prevent the same, these sections may bow up and contact with such rollers thus preventing proper action of the same. To stop this bowing up, plates 81 are extended longitudinally over the return bends at the sides of the sections and are tied down to the bearer angles by bolts 82 in all cases except at the bottom. The bottom line has similar plates 83 bearing on the pipes between the return bends and these plates are tied down by bolts 84 which run through the bearer angles 69.

Thus each section, except at the bottom, is thus bound together with its bearer angles and the plates as a unit and consequently, by breaking joints at the unions previously described, may be slid out without disturbing adjacent sections.

It may be mentioned that the bars 71 are removably secured in position by bolts 85 so that these bars and the rollers may likewise be detached when desired. In the bottom line of steam pipe either the bearer angle 69 may be unbolted from the transverse frame member 68, thus leaving the section free for removal as a unit, or the hold-down plates 83 may be released.

Outside of the operating mechanisms just described extends the casing for enclosing the same, this casing having side walls 86 and a top 87 supported on suitable brackets 88 at the top and bottom.

Having thus described the invention, what is claimed as new, is:—

1. In a veneer or board drier, a housing or drying chamber having high and low temperature ends, heating coils arranged in separate groups and distributed from the high temperature end to the low temperature end of the drying chamber, means for supplying steam to the groups of coils at said high temperature end, means for withdrawing the condensate from said high tem-

perature coils and delivering the condensate to groups of coils at said low temperature end, and means for relieving said low temperature coils of pressure to thereby cause said condensate to flash into steam and thereafter re-condense therein.

2. In a veneer or board drier, a housing or drying chamber, having high and low temperature ends, heating coils arranged in separate groups and distributed from the high temperature end to the low temperature end of the drying chamber, means for supplying steam to the groups of coils at said high temperature end, means for withdrawing the condensate at the low temperature end of each group of steam coils and transmitting the steam to the next succeeding group of steam coils, means for delivering the condensate from all of the groups of steam coils to the last group of coils at the low temperature end of the drier, and means for relieving said last mentioned coils of pressure to thereby cause said condensate to flash into steam which thereafter re-condenses therein.

3. In a veneer or board drier, a housing or drying chamber having high and low temperature ends, heating coils arranged in separate groups and distributed from the high temperature end of the chamber to the low temperature end thereof, an air heater for supplying a drying medium to said chamber, said air heater being provided with steam heater coils, means for supplying steam to said last mentioned coils and to the groups of coils at said high temperature end of the heating chamber, means for withdrawing condensate from said air heater coils and from said high temperature coils and delivering it to groups of coils at the low temperature end of said chamber, and means for relieving said last mentioned coils of pressure to thereby cause said condensate to flash into steam and thereafter re-condense therein.

In testimony whereof I affix my signature.

ARTHUR J. VANCE.