

(No Model.)

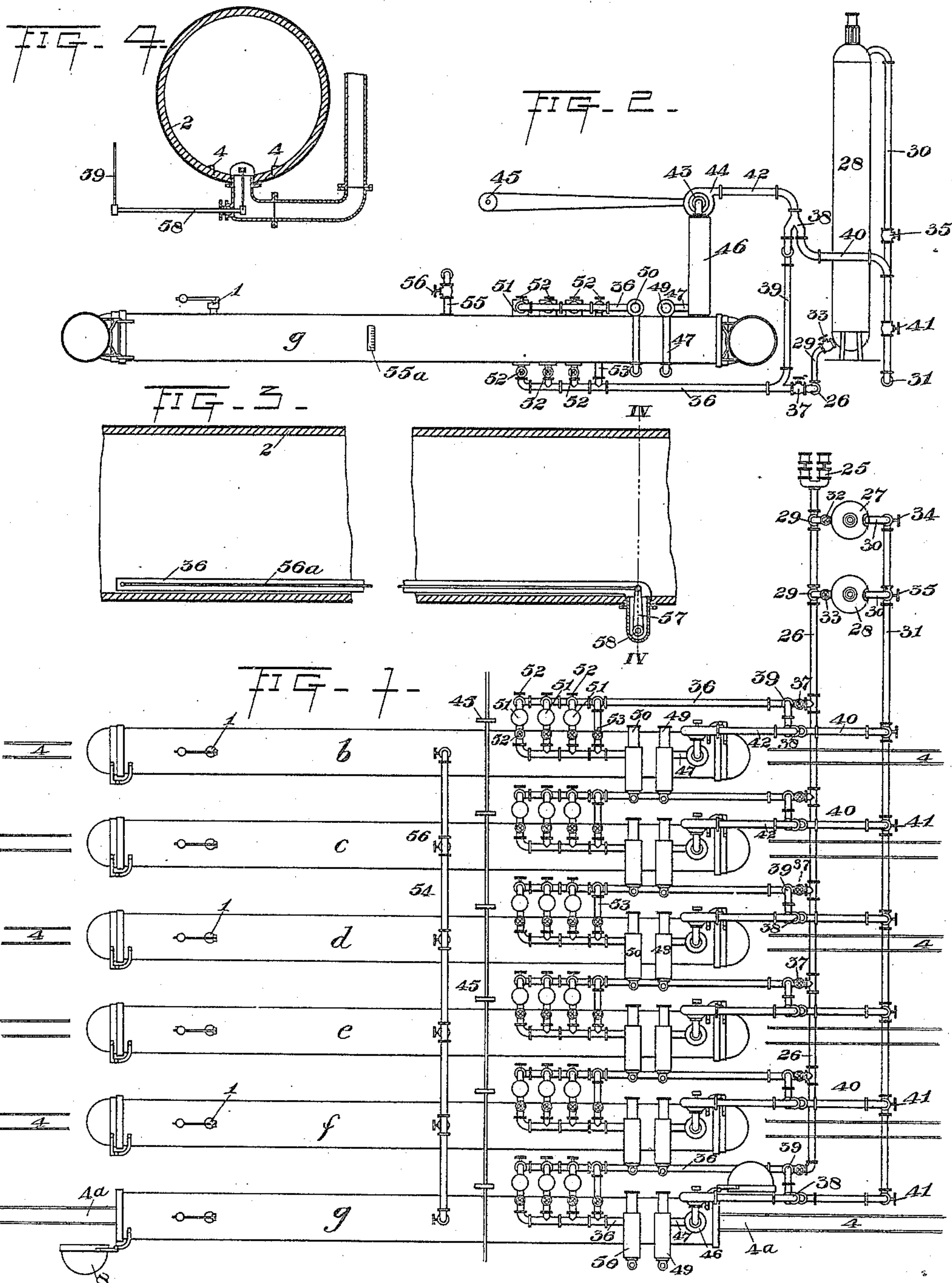
2 Sheets—Sheet 1

J. P. WITHEROW & G. CURTIS.

APPARATUS FOR VULCANIZING WOOD.

No. 446,500.

Patented Feb. 17, 1891.



WITNESSES

H. L. Gill
J. K. Smith

INVENTORS.

James P. Witherow; - Grace Curtis
by their Attorneys
W. C. Davenport & Sons

(No Model.)

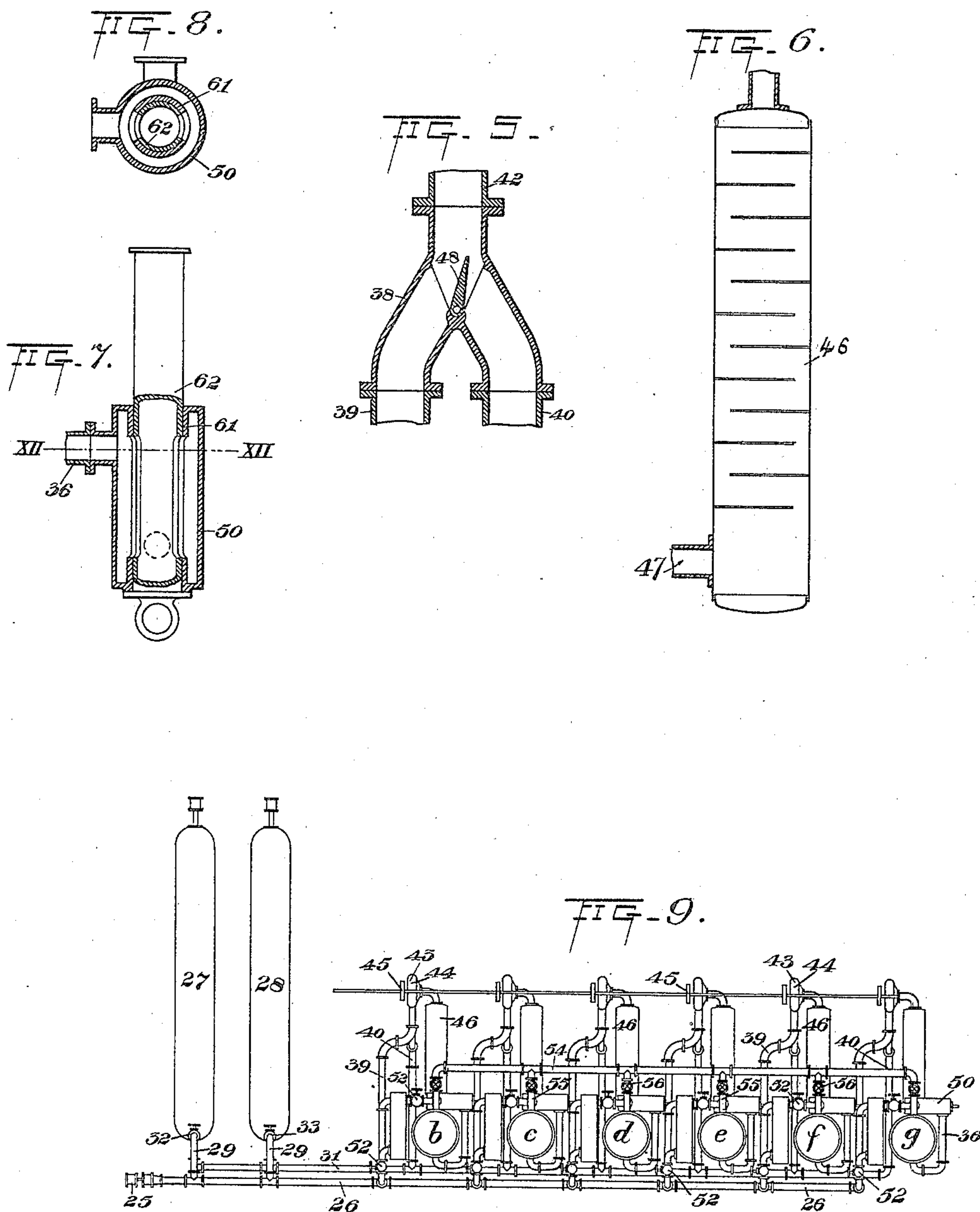
2 Sheets—Sheet 2.

J. P. WITHEROW & G. CURTIS.

APPARATUS FOR VULCANIZING WOOD.

No. 446,500.

Patented Feb. 17, 1891.



WITNESSES

H. L. Gill
J. K. Smith

INVENTOR

James P. Witherow. Grace Curtis.
by their Attorneys
W. B. Russell & Sons

UNITED STATES PATENT OFFICE.

JAMES P. WITHEROW, OF PITTSBURG, AND GRAM CURTIS, OF ALLEGHENY,
PENNSYLVANIA.

APPARATUS FOR VULCANIZING WOOD.

SPECIFICATION forming part of Letters Patent No. 446,500, dated February 17, 1891.

Application filed November 26, 1889. Serial No. 331,675. (No model.)

To all whom it may concern:

Be it known that we, JAMES P. WITHEROW, of Pittsburg, and GRAM CURTIS, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Vulcanizing Wood, of which the following is a full, clear, and exact description.

Our invention relates to an apparatus designed for the practice of the process of vulcanizing wood for the purpose of preserving it and preventing its decomposition. The vulcanizing process, of which, broadly considered, we do not claim to be the first inventors, consists in subjecting wood to a considerable degree of heat—say from 200° to 1,000° Fahrenheit—while the wood is contained within a chamber in which is maintained an air-pressure of sufficient extent to prevent the heat from boiling its sap or contained moisture, the result of the process being a coagulation or solidification of the albuminous constituents, so that the wood is rendered to a certain extent impervious to moisture, and is enabled to resist for a long time the natural process of decay. Although this process has been for a long time known to the art, yet its successful practice has been impeded by the defective nature of the apparatus hitherto employed.

The object of our invention is to improve the construction of such apparatus, and to provide means by which the treatment of wood by this process may be performed rapidly and economically.

The particular type of apparatus to which the invention relates is that in which the wood is heated in a chamber, not by heat applied externally thereto, but by the introduction thereinto of heated compressed air.

The apparatus is clearly described in the following specification, and the novel features thereof which we desire to cover by this patent are briefly stated in the claims.

We shall describe our improvement with reference to the accompanying drawings, in which—

Figure 1 is a plan view of our improved apparatus. Fig. 2 is a side elevation thereof. Fig. 3 is an enlarged vertical longitudinal section of one of the retorts or cylinders in

which the wood is treated. Fig. 4 is a vertical cross-section on the line IV IV of Fig. 3. Fig. 5 is an enlarged vertical section of part of the apparatus. Fig. 6 is a vertical section of one of the air-drying chambers. Fig. 7 is a vertical section of one of the sampling-chambers. Fig. 8 is a vertical cross-section on the line XII XII of Fig. 7. Fig. 9 is a general end view of the apparatus.

Like symbols of reference indicate like parts wherever they occur.

In the drawings, *b, c, d, e, f,* and *g* represent a series of cylinders or retorts designed for treating wood for the purpose of preserving the same, and each provided with a suitable safety-valve 1. We have shown six of these cylinders; but it should be understood that there may be a greater or less number of them employed in connection with the other parts of the apparatus. Each cylinder consists of an exterior metal shell, made preferably of boiler-plates riveted together in the usual manner, and having an interior lining 2 of fire-brick. The cylinders may be made of any length and diameter suitable to the dimensions and style of the timber to be treated therein; but it is necessary that they should be made strong and air-tight, so that when in use they shall not be injured by the internal pressure to which they are subjected, and shall not permit the escape of the air therefrom. The cylinders are provided with air-tight doors at each end, with tracks 4 extending through them, and affording means for cars loaded with wood to be introduced at one end and to be withdrawn at the other.

Parts of the track 4^a are made removable, so as not to interfere with opening or closing of the doors.

We shall now describe the apparatus which we employ in compressing, heating, and distributing the air.

25 is an air-compressor, one or more of which compressors may be used in connection with our apparatus, and 26 is a pipe which leads therefrom along the series of cylinders or retorts.

27 and 28 are stoves of suitable internal construction, the bases of which are connected by pipes 29 with the pipe 26, and the upper portions of which are connected by pipes 30

with a pipe 31, extending parallel with the pipe 26. The pipes 29 are provided with valves 32 and 33 and the pipes 30 with valves 34 and 35, respectively. Each of the cylinders or retorts is connected with the pipe 26 by a pipe 36, provided with a cut-off valve 37. The pipe 36 enters the cylinder at the front end, and extends therein to the rear, as shown in Fig. 3, the reason for this arrangement being that by placing the pipe within the cylinder we avoid the necessity of employing special expansion-joints or other appliances to compensate for the elongation or contraction of the pipe under the influence of heat. The cylinders are joined by a common connecting-pipe 54, having branch pipes 55 leading to the several cylinders, and each provided with a valve 56, so that any cylinder may be cut off from communication with the others, and so that any two or more of the cylinders may be thrown into intercommunication. The purpose of this will be explained hereinafter.

At or near each of the cylinders is a branch or Y-shaped pipe connection 38, one leg of which is connected by a pipe 39 with the pipe 36, the other leg being connected with the pipe 31 by a pipe 40, which is provided with a valve 41. The main portion of the Y is connected by a pipe 42 with a chamber 43, containing a fan or blower 44, which is driven by a belt from a pulley-wheel 45 or other source of power, and within the Y is a switch-valve 48, which may be moved to put the main portion of the Y and the pipe 42 in communication either with the pipe 39 or with the pipe 40 and to shut it off from the other, or in communication with both, to the same or an unequal extent, accordingly as the valve is set at its middle position or at one side or the other thereof. In Fig. 5 the valve is shown in an intermediate position to establish communication between the pipes 42 and 39 and 40, but somewhat more with the pipe 39 than with the pipe 40. The fan-chamber 43 preferably communicates with a drying-chamber 46, containing quicklime (CaO), or other substance having a strong chemical affinity for water, so that the air passing therethrough may be deprived of its moisture. The drying-chamber communicates by a pipe 47 with the front part of the retort or cylinder. The preferable internal construction of the drier-chamber is clearly shown in Fig. 10. It consists of a cylinder or chamber containing a series of shelves or baffle-plates projecting alternately from opposite sides, so as to afford a zigzag course to the passing air. The lime or other material is piled on these shelves, and their alternate arrangement is such that the air is brought into intimate contact with the lime and is thoroughly desiccated.

In order to afford means for observing from time to time the progress of the vulcanizing process on the wood under treatment, we may employ sample-chambers 49 and 50, the chamber 49 being interposed in the line of the

pipe 47, between the drier and the vulcanizing-cylinder, and the chamber 50 being interposed in the line of the pipe 36. We describe the construction of the sample-chambers below. For purposes of subjecting the air prior to its entrance into the vulcanizing-cylinder to the action of chemicals for the purpose of modifying the color of the wood or otherwise affecting it we may divide the pipe 36 into two branches and connect them by a series of parallel vessels 51, each provided with a valve or valves 52, by which any or all of them may be put into circuit or cut out of circuit. These vessels contain a chemical substance or substances by which the passing air is impregnated, and for the purpose of providing a passage for the air when all the vessels are cut out of circuit there is a parallel by-pass pipe 53, also provided with suitable valves.

In the use of the apparatus one or more of the chemical chambers may be included in the circuit, either with or without opening the by-pass pipe, so that the whole or a part only of the circulating air may be subjected to the action of the contents of such chambers.

The preferable construction of the sample-chambers is shown in Figs. 7 and 8. Each consists of a hollow cylinder or chamber or 50, having inlet and outlet pipe connections for the pipe 47 or 36, in which the chamber is interposed. Within this cylinder is a smaller hollow cylinder 61, having opposite slots in its sides, and within the cylinder 61 is a cylinder 62, which can be moved longitudinally within the cylinder 61. The sides of the movable cylinder are slotted in a manner similar to the cylinder 61, so that if it be inserted into the latter cylinder and turned axially so that the slots shall register there shall be an unobstructed opening between the inner cylinder and the outer one. In using this device the inner cylinder is drawn out so as to expose the slotted sides, the sample of wood is placed therein, and the inner cylinder then pushed back into place. It can be withdrawn without permitting the compressed air to escape by first turning the inner cylinder so as to bring the closed or unslotted portion of its side in register with the slots of the outer cylinder and then pulling it out.

By providing the retort with two sample-chambers, one in the air-delivery pipe and the other in the exit-pipe, we are enabled to observe the conditions of the air both before and after its passage through the retort.

At the beginning of the vulcanizing process the operator places in each of the sample-chambers a piece of wood of the same character as that contained in the large cylinders or retorts and from time to time draws them out therefrom in the manner above explained, so as to note their condition. These samples show the progress of the process, and also serve to indicate any difference in conditions between the entering and outgoing

air, and there is thus afforded a very efficient means of observing and controlling the operation of the apparatus.

It will be understood that each of the retorts is provided with the parts designated on the drawings by Figs. 36 to 47, inclusive. This is clearly shown in Fig. 1.

The operation of the apparatus in treating wood is as follows: The cylinders or retorts, or any number of them, is or are charged by loading the wood on cars and running them into the cylinders. The doors at the ends of the latter are then shut and tightly sealed. That one of the stoves 27 or 28 which has been heated by internal combustion to the required temperature (say the stove 28) is connected with the pipe 26 by opening the valve 33 and with the pipe 31 by opening the valve 35, the other stove being cut off from these pipes by closing of its valves 32 and 34. The air-compressor 25 is then set in action, and by means thereof the whole system, including the stove and the pipes and cylinders communicating with the compressor, is charged with compressed air, the pressure or tension of which may be increased to the limit desired. Of course if any of the cylinders be not charged with wood, or if for any other reason it is not desired to charge them with compressed air, they may be cut off from communication with the compressor and excluded from the system above mentioned by closing the valves 37 and 41. The compressed air contained within the stove 28, and so much thereof as is forced through the same by the action of the compressor, is heated by contact with the hot flues or walls. When a proper internal pressure in the system has been attained, a circulation of air through the retorts and through the stove is set up by starting the fan 44. This induces a current of air from the front of the retort through the pipe 47, sample-chamber 49, drier 46, fan-chamber 43, pipe 42, and (supposing the valve 48 to be in position to connect the pipe 42 with the pipe 40) through the pipe 40, pipe 31 into the top of the stove 28, through the stove, pipe 29, pipe 26, pipe 36, and chemical chamber or chambers 51 (if the same be included in the system) to the rear of the retort. This circulation is maintained until by repeated passage through the stove the air has become heated to the degree of temperature desired, which may be ascertained by use of a pyrometer 55^a, connected with the retort. When the desired temperature has been attained, the further elevation thereof may be checked by turning the valve 48 so as to make only partial communication of the pipe 40 with the pipe 42, as shown in Fig. 5, the effect of which is to divide or partially short-circuit the air-current passing through the Y-pipe, and to cause a part thereof to return to the retort by the pipe 39 without passing on through the heated stove, as in the course above explained. By setting the valve 48 so as to properly proportion the volumes of the air passing through the

pipes 39 and 40 any desired temperature in the retort below the limit afforded by the heat of the stove may be constantly maintained. If it be desired to check rapidly the temperature of the retort, the valve may be set so as to cut off entirely the communication between the fan-chamber and the stove and to short-circuit the entire air-current, directing it back through the pipe 39 into the retort. The valve therefore affords a very convenient and practical mode of regulating the temperature of the retorts, and as each retort may be provided with a separate fan and system of connecting-pipes the temperature of each may be regulated individually and may be fixed at any degree suitable to the degree of heat to be applied to the wood and to the kind and condition of the wood to be treated, for in practice it is found that different degrees of heat produce dissimilar results and that to produce given results different sorts of wood require the application of different temperatures. The temperature of the retorts is thus governed by regulation of the switch-valves 48, and the internal pressures are governed by controlling the air-compressor, checking or increasing its action accordingly as the pressure exceeds or falls below the proper degree. The valves may, however, be regulated automatically by means of mechanical connection with the pyrometers. We have shown in Figs. 3 and 4 means well adapted to this end. The pipe 36 within the retort is usually made of iron, and within the pipe we arrange a rod 56^a of some other metal—say copper—having a different coefficient of expansion under increase of temperature. This rod is fixed to the pipe 36 at one end thereof and at the other end is joined to a crank-lever 57, which projects from a short rotary shaft 58, extending through a stuffing-box and connected by a crank-arm and connecting-rod 59 to the stem of the switch-valve. In the use of this device a variation in internal temperature of the cylinder or retort will cause the contraction or elongation of the pipe 36, and the inclosed rod 56 will likewise contract or elongate; but the differences in composition of the pipe and rod will effect a differential action on the lever 57 and shaft 58, which will be communicated to the regulating-valve. By properly setting the parts of this mechanism the valve may be caused to move so as to divert the proper proportions of heated air through the branches of the switch to maintain the retort or cylinder at a constant temperature. It will be understood that the stoves are used alternately—that is to say, while the compressed air is passing through one of them the other is heated by internal combustion of gas, so as to bring its flues to the proper temperature to heat the air when the companion stove has by radiation lost its heat to such extent as to render it inefficient for that purpose. By thus employing two or more stoves their operation is rendered continuous. During the continuance of the operation the

circulating air is prevented from becoming surcharged with moisture by the desiccating action of the contents of the drying-chamber through which the air passes. The use of this drier may not be necessary in all cases, and it therefore may be omitted, or a suitable condenser for causing the deposit of moisture from the air may be substituted for it. We intend, however, to claim its use specifically, since in treating wood containing an excess of moisture it is of marked advantage. The effect of the action of the heated air on the wood in the retorts has been already explained, and as the process employed has been known in the art and is not broadly of our invention it is unnecessary in this specification to state in detail the proper degrees of heat and pressure needed to effect given results. When the wood in any of the cylinders has been sufficiently treated, that cylinder is cut off from the remainder of the apparatus by means of its valves, the air-pressure therein is reduced, the door at the rear of the cylinder is opened, and the car with its load of wood is withdrawn. This may be done without in any way checking or interfering with the progress of the operation in the other retorts.

In an application of James P. Witherow for United States Letters Patent, filed November 26, 1889, Serial No. 331,689, there is shown and described an apparatus in many respects similar to the apparatus herein shown and described, and the following items of invention *inter alia* are claimed:

35 The alternately-acting stoves, in combination with the air-compressor, retorts, and connecting-pipes; the combination, with several retorts in a plant of the character described, of an independent pressure-regulating valve for each retort; the combination of the retort, stove, air-compressor, two pipe-connections—
40 one from the compressor through the stove to the retort, the other directly from the compressor to the retort—and an interposed common mixing-chamber; the combination of the
45 air-compressor, stove, and a retort having a metal shell and interior brick lining.

We claim—

1. In apparatus for treating wood, the combination of a series of two or more retorts or
50 chambers, a stove or stoves, an air-compressor, all connected in a single system or plant, and said retorts being provided with valves by which any of them may be cut out from the
55 system, and separate fans or blowers for each retort or chamber for maintaining a circulation of air therethrough, substantially as and for the purposes described.

2. In apparatus for treating wood, the combination, with the retort or chamber and an
60 air-compressor and air-heater, of an air-conducting pipe entering the retort or chamber at or near one end and extending therein to the other end, and a second pipe leading from

the first-named end of the cylinder, substantially as described and set forth. 65

3. The combination of the retort or chamber, the air-compressor, and stove or stoves, a delivery-pipe leading from the stove to the retort or chamber, a return-pipe leading to
70 the stove, and valve-controlled return-connections between the retort and the return-pipe of the heater and between the retort and the delivery-pipe of the stove or stoves, and means for maintaining the air-circulation,
75 whereby the air may be caused to circulate through the stove and retort directly, or a part or all of the air-current may be short-circuited to exclude the stove, substantially as and for the purposes described. 80

4. The combination of the retort or chamber, the air-compressor, and stove or stoves, a delivery-pipe leading from the stove to the retort or chamber, a return-pipe leading to
85 the stove, a return-pipe leading from the retort or chamber, a branched connection connecting the same with the retort or chamber and with the heater, and a switch-valve in said branched connection, substantially as
90 and for the purposes described. 90

5. The combination, with a series of two or more retorts or chambers, of an air-compressor and stove or stoves, a delivery-pipe and a return-pipe leading to and from the stove or
95 stoves, valve-controlled branch pipes connecting the delivery-pipe with the retorts or chambers, and branch return-pipes connecting the retorts or chambers with the stove return-pipe and also with the retort or chamber,
100 whereby the air may be caused to circulate through the stove and the retorts or chambers directly, or a part or all of the air may be short-circuited through one or more of the retorts to exclude the stove or stoves, substantially as and for the purposes described. 105

6. In apparatus for treating wood, the combination, with a retort or chamber, a stove or stoves, air-compressor, and pipes connecting the same in a system, of a drier-chamber adapted to contain moisture-absorbing material, substantially as and for the purposes described. 110

7. In apparatus for treating wood, the combination, with a retort or chamber, of circulating-pipes by which air is fed thereto and
115 drawn therefrom, and sampling-chambers interposed both in the supply and delivery pipes, substantially as and for the purposes described.

In testimony whereof we have hereunto set
our hands this 26th day of September, A. D. 1889. 120

JAMES P. WITHEROW.
GRAM CURTIS.

Witnesses:

JOHN F. WILCOX,
W. B. CORWIN.