(No Model.) 6 Sheets—Sheet 1.

J. H. YOUNG.

APPARATUS FOR IMPREGNATING WOOD.

No. 329,799. Patented Nov. 3, 1885.

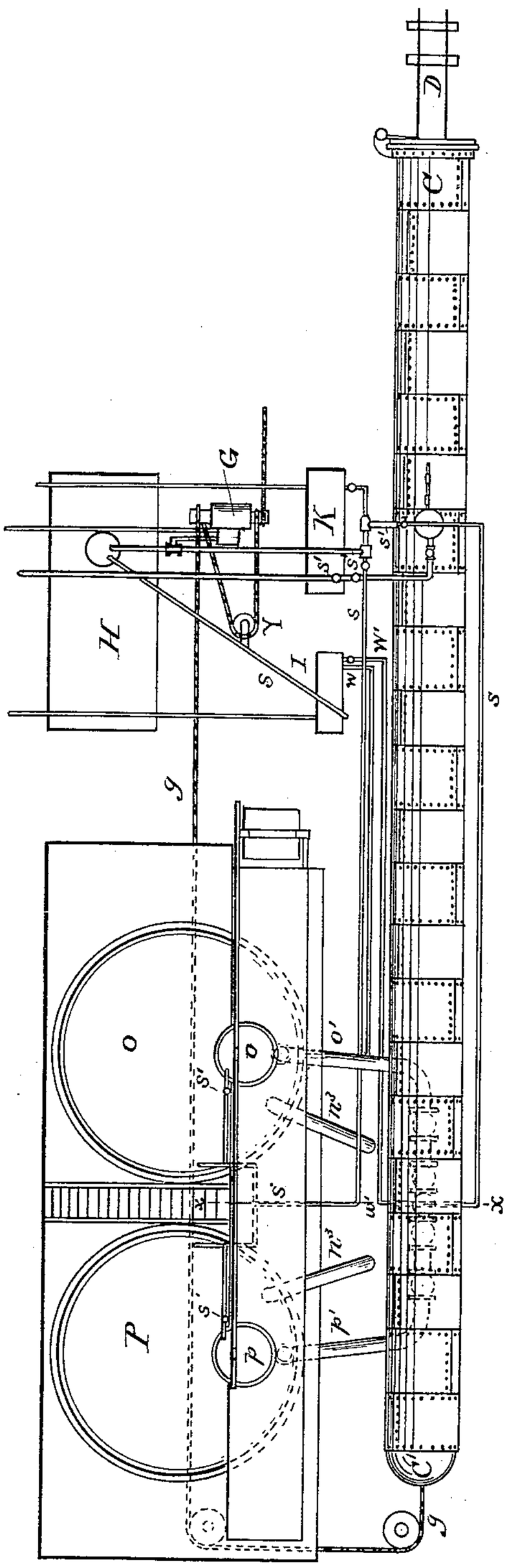

FIG. 1.

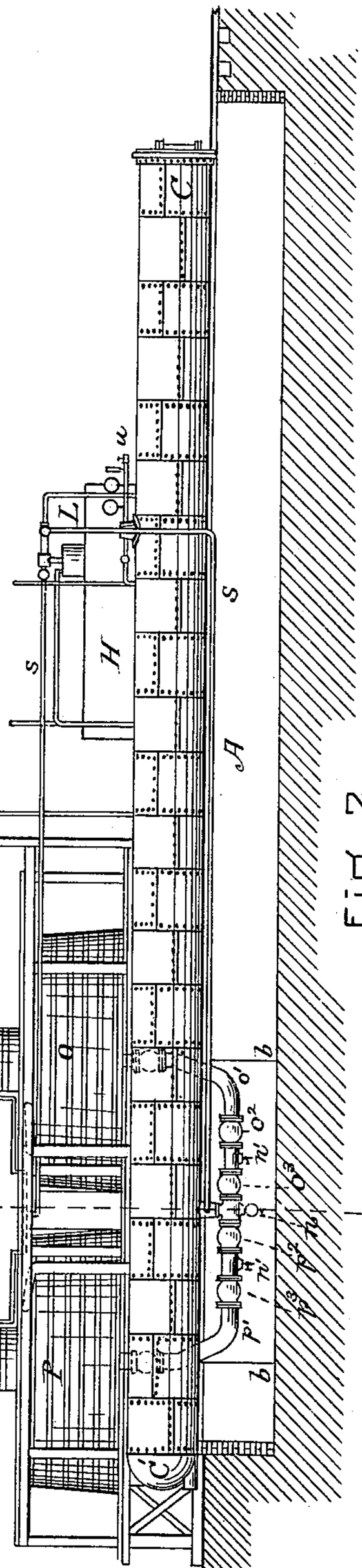

FIG. 2.

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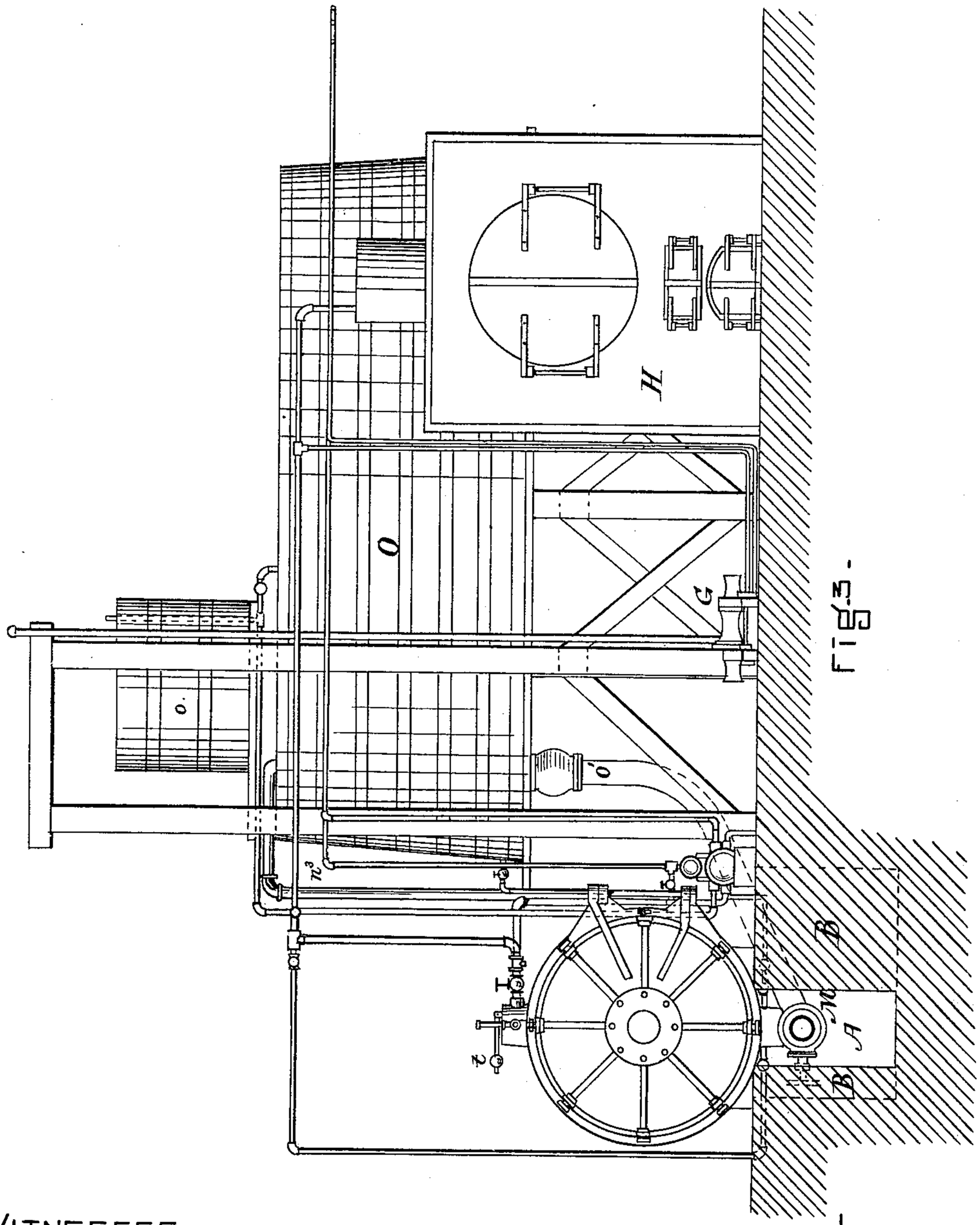

FIG. 3.

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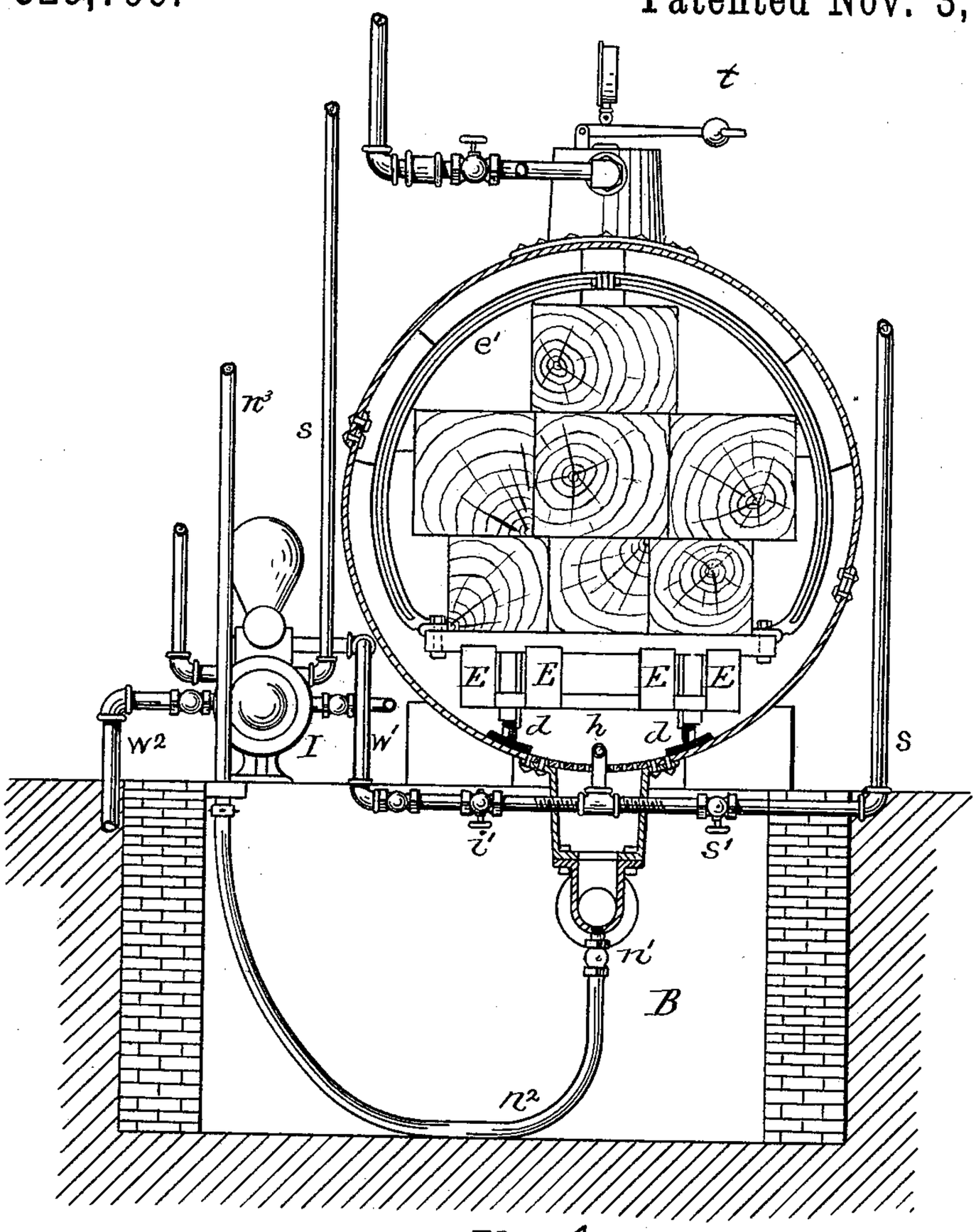

Fig. 4.

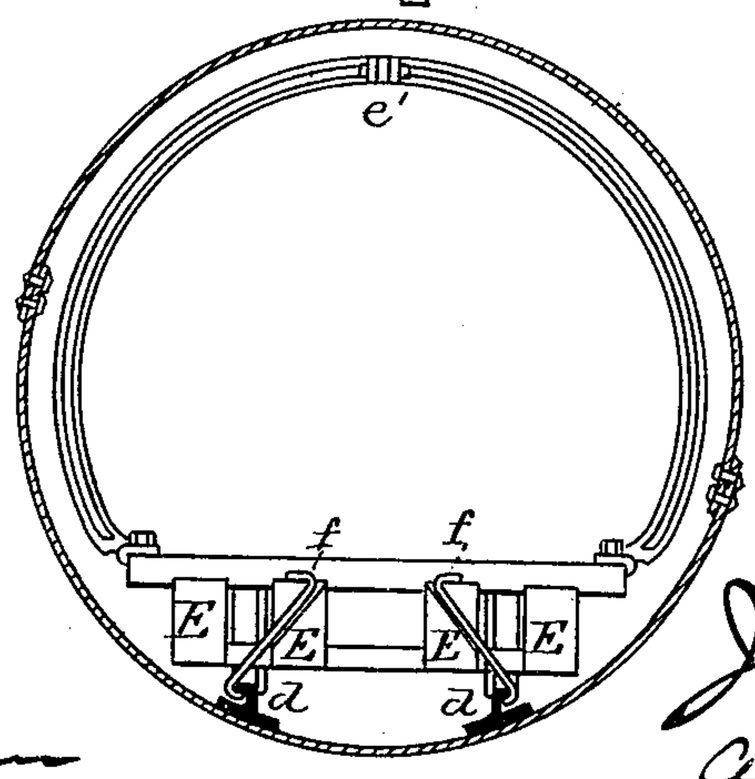

Fig. 5.

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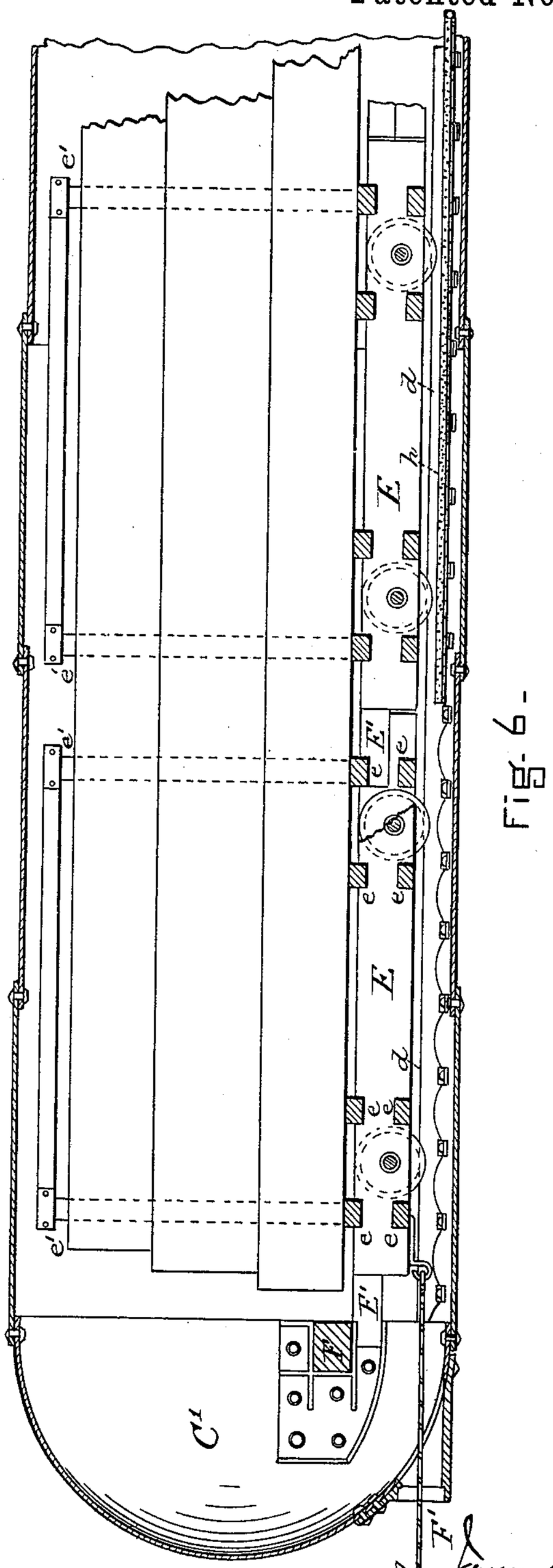

FIG. 6.

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(No Model.) 6 Sheets—Sheet 5.

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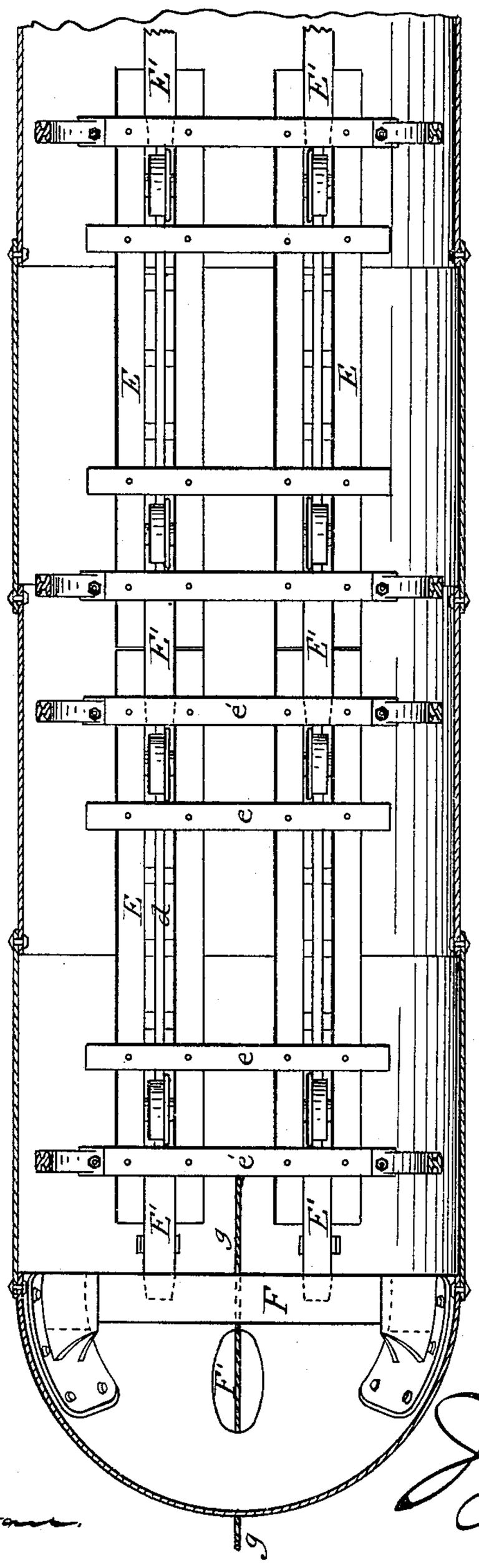

FIG. 7.

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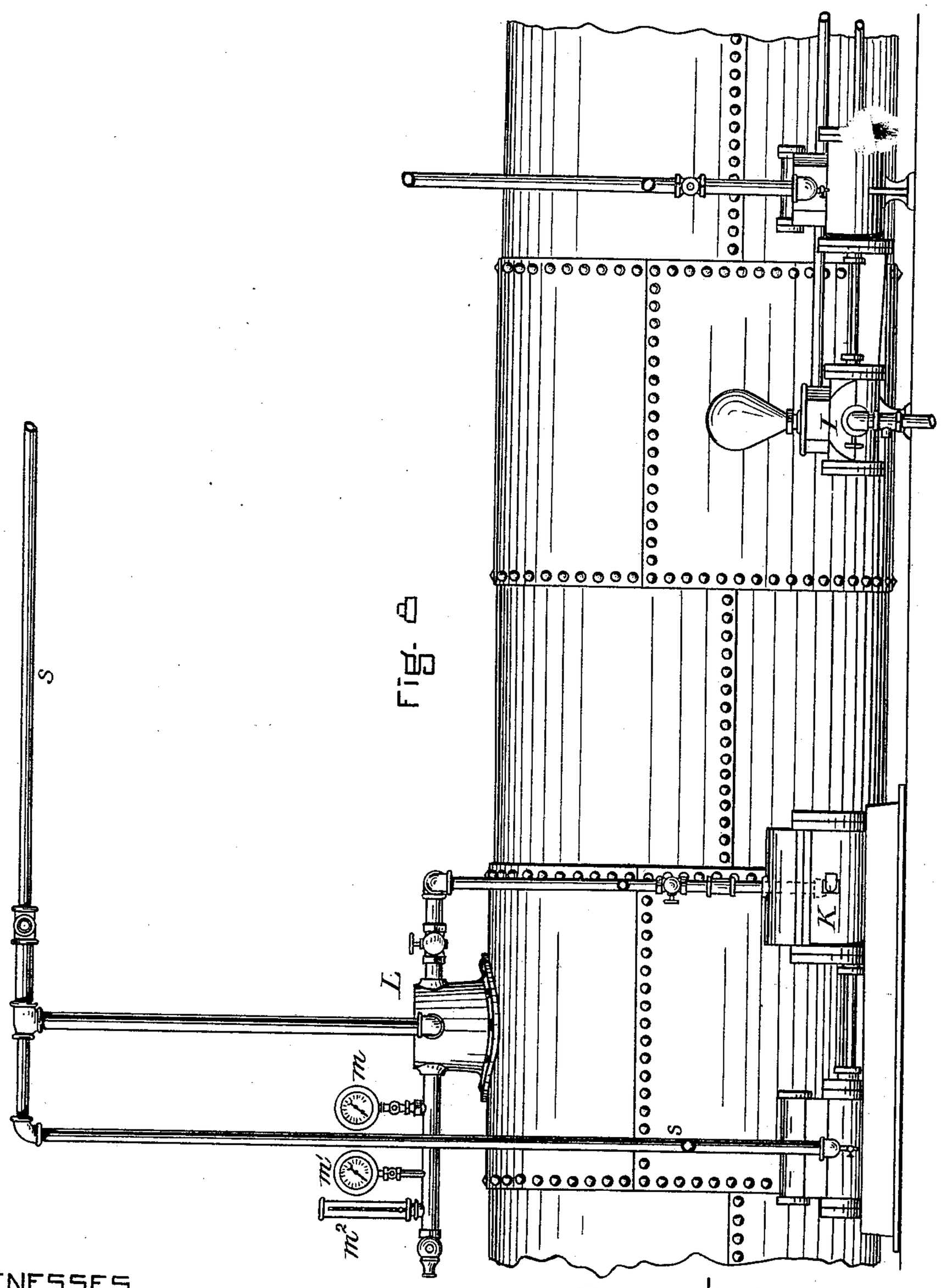

Fig. 6

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UNITED STATES PATENT OFFICE.

JAMES H. YOUNG, OF NEW YORK, N. Y.

APPARATUS FOR IMPREGNATING WOOD.

SPECIFICATION forming part of Letters Patent No. 329,799, dated November 3, 1885.

Application filed December 29, 1884. Serial No. 151,393. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. YOUNG, of New York, in the county and State of New York, a citizen of the United States, have invented a new and useful Improvement in Machinery for the Preparation and Treatment of Timber with Antiseptics, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention is designed for the preparation of wood to receive antiseptics, and for the application of antiseptics to the wood so prepared. It is well known that if the sap be removed from timber and its place supplied by antiseptics a considerable improvement in the durability of timber can be made. Among the processes which have been devised for this purpose one, very satisfactory, upon the whole, has been that which was patented March 30, 1869, in Letters Patent No. 88,392, to Charles Karmrodt and Nicholas Thilmany, which is called the "Thilmany process." This consisted, as described in the patent, of three steps: first, the removal of the sap by a water treatment; second, the saturation of the wood with a solution of chloride of barium, and, third, a subsequent saturation with sulphate of copper. The process of driving the water and solutions into the timber, as described in the patent, was by gravity and absorption through the ends of the logs. No machinery was described for performing the work; and it is obvious that impregnation of timber in the manner described in said patent would be a tedious and difficult process. In order to perform the work in a large way upon logs of timber, it was desirable to have machinery adapted for this purpose; and as it was intended to handle large weights of timber, it was desirable to do this work by power. It has also been found, in the interval between Thilmany's invention and the present time, that the use of heat and pressure will improve and accelerate the work; and so it has been common to use, for the purpose of impregnating timber, either by this or other processes, large steaming-cylinders to which pressure can be applied. Inasmuch as sulphate of copper is used in this process, it is practically essential that the cylinder to be employed shall be a copper cylinder, and that the pumps and pipes shall be copper or bronze to a very large degree; but copper is a metal so susceptible to the action of heat that if the steaming of timber is conducted in the ordinary way in a large cylinder of copper—that is, if the steam is admitted only at one point—the copper cylinder will expand on one side so much more than on the other side as to be speedily injured by the working of the joints.

One part of this invention relates to a means of preventing this action. Another part of the invention relates to the arrangement for handling into and out of the cylinder the heavy loads of timber that are to be treated. Another part relates to the arrangements adopted for mounting the cylinder, so that the sap and material used for impregnation can be readily introduced and removed. Another part relates to the machinery and method of applying pressure to the cylinder. Another part relates to the general arrangement and combination of the machinery in a compact form for the purpose of accomplishing the desired result.

In the drawings an apparatus and portions of an apparatus for treating timber nearly one hundred feet long are represented. The cylinder is supposed to be a copper cylinder.

Figure 1 is a plan view, on about the scale of a twelfth of an inch to a foot, of the entire apparatus. Fig. 2 is a side elevation of the apparatus. Fig. 3 is a front elevation of the apparatus upon a scale three times as large as that adopted for Figs. 1 and 2. Fig. 4 is a transverse section of the cylinder, on a still larger scale, on the line *x x* of Fig. 1, showing certain pipes and connections in elevation. Fig. 5 is a transverse section showing the impregnating-cylinder and the timber-car used therein near the front end of the cylinder, and illustrating the means employed to lock the car down and steady it in the cylinder during the progress of impregnation. Fig. 6 is a vertical section of the back end of the cylinder, showing the timber-cars in position, and illustrating the means adopted to lock the cars together and lock them down at the back end, and also the construction of the cylinder at the back end for the purpose of allowing the cars to be drawn in by power. Fig. 7 is a

horizontal section at the back end of the impregnating-cylinder, with an unloaded car in place. Fig. 8 is a side elevation of the impregnating-cylinder and the pressure-pumps employed with the gages and attachments, and this view is taken from a position at or near the point *y* on the plan view Fig. 1.

The views Figs. 1 and 2 are on a scale of about one-twelfth of an inch to the foot of the large apparatus, and Fig. 3 about a quarter of an inch to the foot of the large apparatus, while the views in Figs. 4, 5, 6, 7, and 8 are on a scale of about half an inch to a foot.

Like letters indicate like parts in all the figures.

In describing the apparatus and the relation of the parts to each other it will be best to give a description at the same time of the relation of the apparatus to the process performed by it. In order that the cylinder may be properly inspected, it is mounted over a pit, (shown at A, Figs. 2 and 3,) which pit, at or about the place of the section-line *x x*, is made considerably wider than it is at other points, as shown in Figs. 3 and 4 at B. In this enlarged portion of the pit, which extends for about the distance shown in Fig. 2 between the points *b b*, are placed the principal parts of the piping which form the outside lower connections with the interior of the steaming-cylinder. These are called the "lower dome." The cylinder is properly mounted and set over the pit, and is marked in the drawings C C′, Figs. 1 and 2. This cylinder is riveted up in substantially the same way that a cylindrical steam-boiler is riveted up, and at its front end, C, there is a door that can be securely packed and tightly fastened. Through this door the timber is to be introduced. The railroad-track (marked D) extends up to the front end of the cylinder, and on this track the cars stand while receiving their load of timber, and over it they are rolled up to the door of the cylinder. A continuation of this track extends into the cylinder for substantially its whole length, as shown at *d d*, Figs. 4, 5, and 6. The cars which are employed to carry in the timber are of comparatively short lengths—about eight feet—as shown in Fig. 6. They are made with longitudinal timbers, between which the wheels are adapted to revolve, which timbers are marked E E. Transverse timbers *e e* bind these longitudinal timbers together on each side of the wheels, above and below the longitudinal timbers. Metallic hoops at the ends of each car, substantially conforming in shape to the interior of the cylinder, are made fast to the transverse timbers *e* of the car, and serve to hold the timbers down to the car. These hoops are marked in the drawings, Figs. 4 and 5, *e′*. Between the longitudinal timbers E, which form the bed of the car, at the part of the car which is to be the back end, are placed projecting spurs, (marked E′.) These spurs in the car that is run to the back end of the cylinder lock under a transverse beam, F, which thus serves to hold down the back end of the nearest car. These spurs E′ of the succeeding cars lock under the transverse timbers *e* of the preceding car, and so lock the cars successively together from one end of the cylinder to the other. At the front end, near the door, the end of the car of the train, close to the door, is locked to the rails *d* by means of the hooks shown in Fig. 5. The interior longitudinal beams, E, have small recesses cut in their ends large enough for the reception of two S-hooks, *f f*, one end of which S-hooks is adapted to hook into the top of the longitudinal timber E and the other end to go under the lateral projection of the rail-head upon its outer side. These S-hooks *f*, if desired, can be applied to the front end of each car; but it is not usually desirable to do it. By this system of locking cars to the cylinder the cars themselves are prevented from flotation when the cylinder is full of the impregnating-fluids, and the bands or hoops *e′*, fastened to the car and going over the timber, prevent the timber from being displaced on the car in the cylinder by similar flotation. I also block the timber away from the cylinder by wedges inserted after the cars are in place. In order to draw the cars into the cylinder, at the back end is made a manhole. (Shown at F′ in Figs. 6 and 7.) Through this man-hole, when it is required to draw a train of cars into the cylinder, is passed a rope, *g*, which rope is shown in plan in Figs. 1 and 7, and in elevation in Fig. 6, and which leads to the steam-winch G, by means of which the timber-loaded cars are drawn into the cylinder, and when drawn in the rope *g* is detached from the back end of the train, and the man-hole F′ is packed by its cover. As an essential part of this apparatus, there is a steam-boiler, H, for heating the impregnating-solutions and for steaming the wood. This boiler is shown in Fig. 3. Steam-pipes *s* are led from the boiler, with branches to the steam-pumps I and K, Fig. 1, for the purpose of supplying the pumps with the steam necessary to work them. One of these pumps, I, is a liquid-pump, and the other, K, an air-pump, and these pumps are connected with the two domes of the cylinder—the air-pump to the upper dome (represented at L, Fig. 2) and the liquid-pump I to the lower dome, M, Fig. 3—and other branch steam-pipes *s* lead to the tanks O and P and *o p*, for the purpose of heating the liquids therein contained, one of which is to be chloride of barium and the other sulphate of copper. Still other branches of the steam-pipes *s* lead to the domes L and M. Each branch is controlled by a valve, *s′*. The air-pump K can be used both as an exhaust-pump and as an air-pressure pump. The steam-connection through the lower dome, M, with the interior of the cylinder C C′ is not for the admission of free steam directly into the cylinder at that place, but it admits steam into the perforated pipe shown at *h*, Figs. 4, 6, and 7, which runs through about two-thirds of the length

of the cylinder in its longitudinal lower center. Steam admitted through the upper dome, L, is admitted through it directly to the cavity of the cylinder. This perforated steam-pipe *h*, it will be observed in Fig. 7, lies between the tracks *d d*. On admitting the steam from the boiler into the cavity of an impregnating-cylinder through the upper and lower domes, and particularly through the lower dome to the steam-pipe *h*, which lies along nearly the whole length of the central part of the cylinder, the steam, striking against the shell of the boiler, will expand it, and, following up the sides, will continue to expand it, so that the cylinder will be comparatively equally expanded on all sides at once. In letting on steam, it should first be admitted through the lower dome. Of course, the mounting of the cylinder over the pit must be such mounting as will allow the cylinder to move a short distance at each end in consequence of this expansion, which begins at the center and is propagated toward each end. The cylinder having been loaded with timber, run in on the cars, and carefully locked up, the wood is first thoroughly steamed, and by steaming the soluble matters and the sap are dissolved in the steam and hot water so introduced. The pressure of the steam in the boiler may be observed, when desired, by one of the gages *m m'*, one of which gages is a pressure-gage and the other a vacuum-gage. On the same connection with these gages *m m'* is mounted a thermometer, *m''*, serving to mark the temperature. The bulb of this thermometer dips into the cavity of the cylinder. I prefer to use the ordinary mercury-thermometer at this place, because of the likelihood of a thermometer of the pressure-gage sort giving disproportionate results, on account of the alternating pressures and exhaustions that are applied to the interior of the cylinder. When the wood has been steamed sufficiently long, which will vary according to the character and quality of the wood operated on, and which is judged of by the operator, usually a period of three to six hours, (more or less,) the water of condensation and sap are drawn off into the pit through the waste-cock *n* at the bottom of the lower steam-dome. (See Fig. 2.) When all the sap and water of condensation that will run out by gravity have been removed, the waste-cock *n* is closed and the air-pump K set to work to create a vacuum in the steam-cylinder, and thereby remove from the wood a still further quantity of sap, which, in its turn, is allowed to run to waste in the pit.

On reference to the patent already referred to it will be seen that the impregnation of wood was directed to proceed in the order of, first, applying the solution of chloride of barium, and, secondly, the solution of sulphate of copper. I prefer a different order, and am of opinion, from experience, that it is better to introduce the sulphate-of-copper solution first. In order to do this, crystals of sulphate of copper are dissolved in the tank *o*, and crystals of chloride of barium in the tank *p*, making in each a saturated solution. These two tanks stand over the larger tanks O P, which are filled with working-solutions, the bottoms of which tanks are above the cylinder C C', so that their contents will readily flow into the cylinder through the pipes *o' p'*, which lead to the lower dome, M, and are governed by two stop-valves each, o^2 o^3, p^2 p^3, between the bottom of the tank and the lower dome. Between each pair of these two stop-cocks, o^2 o^3, p^2 p^3, is placed a waste-cock, *n'*, having on it a coupling to connect a hose, n^2, to the return-pipe n^3, for return of the impregnating-liquids to their tanks.

From the sulphate-of-copper-tank O, in addition to the pipe *o*, which leads to the lower dome, there is another and smaller pipe, *w*, (shown in plan, Fig. 1,) which leads to the force-pump I, by means of which, after the cylinder has been filled as full as it can by gravity, further quantities of solution may be pumped in to put pressure upon the interior of the cylinder. This steam-pump, being practically automatic, and having its speed regulated by the resistance of the work, to a considerable degree, is to be worked until it is practically stopped by the resistance of the cylinder-pressure employed. The pump so employed with the sulphate-of-copper solution must of course be of gun-metal or bronze, to prevent injurious action of the solution upon the working parts of the pump; but I prefer to use the air-pump K worked as an exhaust to draw in the solution, and the pump I only to put pressure on to a filled cylinder. Provision has been made, as already described, for heating the solution in the tanks before it enters the cylinder, or at the same or a different time that the pump is pumping in the solution steam may be admitted to the perforated steam-pipe; but usually the heat of the solution itself will be sufficient to enable the sulphate of copper to penetrate the wood under pressure. The strength of the solution which I employ is usually about five pounds of sulphate of copper to a hundred pounds of water—a five-per-cent. solution—and it will take, for ordinary kinds of wood about six to nine hours for the thorough absorption of the sulphate-of-copper solution at a hundred pounds pressure and a heat of about 100° Fahrenheit. The connection from tank O to the lower dome, M, is like that from tank P to the same place. At least two stop-valves, o^2 o^3, are inserted in the pipe *o*, and a waste-cock, *n'*, interposed between them. The dome M opens into the interior of the cylinder. If the valve o^2 is shut and the valve o^3 is open, the interior of the cylinder communicates with the cock *n'*. If a hose, n^2, be coupled to this and to pipe n^3, and the cock *n'* be opened, the cylinder-pressure will drive the solution very rapidly out. It would not be desirable to open the pipes at one hundred pounds—the usual cylinder-pressure—and so by this arrangement and work of the valves and cock *n'* the cylinder-pressure is broken to about

twenty pounds, and then the valve o^3 opened, and the solution forced back to tank O through that, as hereinafter described. When the wood has taken a sufficient quantity of the sulphate of copper, a connection is made through the lower dome and waste-cock n' by means of the hose n^2 with a pipe, n^3, Fig. 4. Only one of the pipes which are represented by n^3 is shown in the drawings, Fig. 4, but both are shown in Fig. 1. This pipe may lead to the suction side of the pump I, in order that the cylinder may be pumped out through the pump I and back into the tank; or it may lead directly to the sulphate-of-copper tank; or it may lead to a T, which T has branches leading to the sulphate-of-copper tank, and also to the chloride-of-barium tank, each of which branches would be controlled by a stop-cock. It is not usually advisable to pump back all the sulphate-of-copper solution through the pump, and it is never advisable to pump the chloride-of-barium solution through the pump; so that in order to get the solutions back into the tanks it is preferable to have two pipes, n^3, for returning the solution, and to apply to the cylinder C C′ air-pressure through the air and vacuum pump K, keeping the cylinder closed, except at the return-pipe, by which the solution will be driven back through the lower dome, waste-cock n', and through the hose n^2 and stand-pipe n^3, till the pressure is broken, and then through pipe o to the proper tank. When the sulphate-of-copper solution has been removed from the cylinder and restored to the tank, it is to be tested by the hydrometer, and its proper working strength restored by putting in additional crystals or, better, saturated solution from tank o to bring it up. All connection between the cylinder and the sulphate-of-copper tank being first shut off, the chloride-of-barium solution is now allowed and made to run into the cylinder through the lower dome by gravity and by the air-pump K, worked as an exhaust-pump. When the chloride-of-barium solution has filled the cylinder, instead of pumping a portion of the solution through the pump I, which I have found by experience to be injurious to the pump, I apply the necessary pressure through the pump I by pumping water into the impregnating-cylinder, and by this means can get sufficient pressure to force the chloride-of-barium solution into the pores of the wood. This would require, if the water were introduced at the top, the chloride-of-barium solution to be a little stronger than would be required for the amount of copper already forced into the wood; but when water is pumped in at the bottom it does not seem to interfere with the strength of the solution or to make it irregular in its quality at the level of the timber in the cylinder, while water introduced anywhere would interfere with the strength and quality of the copper solution at that level. The chloride-of-barium solution should be of about the strength of three pounds of crystals to a hundred of water, or three-per-cent. solution, and when the wood has absorbed all the chloride-of-barium solution that it will take the cylinder is emptied of the solution by attaching the hose to the waste-cock n' of pipe p', as before, and the other end of the hose to the proper pipe, and driving the solution back into its tank by air-pressure, and the solution is then restored to working strength. Heat may be imparted to the chloride-of-barium solution in the cylinder by the admission of steam through the steam-pipe, as already before described with regard to the solution of sulphate of copper. When the chloride-of-barium solution has been entirely drawn off, the loaded cars are withdrawn from the cylinder and the timber removed from them, when the process may be repeated, as above described. A safety-valve, t, Fig. 3, is applied on the upper dome to prevent excess of pressure, and a gage-cock at u serves as a means of ascertaining when the exhaustion of the air-pump K has completed its work of filling the cylinder with fluids. By use of the auxiliary tanks o and p, each containing a saturated solution, the strength of the working-solutions can be more rapidly and certainly brought up, and danger of injury to the pump I or the valves from grit avoided. By employing the air-pump to draw in the solutions, and by the use of water to obtain pressure in the cylinder, instead of pumping the solutions to obtain pressure, iron pumps and pipes may be used, instead of copper or bronze; and if water-pressure only is used the pump I will have a force-pipe, w', branched to the tanks O P o p and to the lower dome, M, and a water-supply pipe, w^2, as shown in Fig. 4, and will have no induction-connection with the tanks; but it is believed preferable to have a copper pump, and draft and force the last part of the copper solution by the pump I. After breaking the pressure, as described, by having valve o^3 or p^3 open and valve o^2 or p^2 shut, according to the solution, by aid of the hose-connection and waste-cock n' and pipe n^3 valves o^2 or p^2 are opened and the solution returned to the proper tank by the way it came, when the pipe o or p will be closed by shutting a valve in it. Of course, the pump I, if used to pump the copper solution, must be washed out by pumping water afterward. It will be seen that the combination of the dome M with the tank O by its proper pipes, valves, cocks, and hose is just the same as its combination with the tank P by its proper pipes, valves, cocks, and hose, and that each of these tanks O and P alternates with the other, in combination with the cylinder, and that both may be shut off from the combination with the cylinder, and the cylinder will then only have communication through the dome and waste-cock n with the pit B.

It is obvious that instead of the two valves o^2 o^3 or p^2 p^3, with the cocks n' between them, one of the valves o^3 or p^3 and the cock n' might be dispensed with, and the connection of the hose n^2 made with cock n; but this would in-

volve a common pipe for the two solutions, and be apt to injure the valves. I therefore prefer the way described, although the principle of breaking pressure by a small cock placed between two valves would be practiced in the case supposed.

The mechanical combination between one set of tanks and the rest of the apparatus is, as a mechanism, like that between the other set of tanks and the apparatus. Only one set of tanks is to be connected with the cylinder at a time. The other is to be shut off. When, therefore, they are mentioned in the claims as tanks O and P, valves o^2 p^2, &c., it must be understood that only one is to be opened into the cylinder at a time, and that one or both is always to be shut off. A like rule applies to the double connections of pipe h'.

Having thus fully described my invention, I claim, in an apparatus substantially as described, and desire to secure by Letters Patent of the United States—

1. In combination with a wood-steaming linder, C C′, the two independent steam-entrances L and M, communicating directly with the cavity of the cylinder, in combination with the perforated floor-pipe *h*, communicating, through the perforated floor-pipe, with the cavity of the cylinder at various points along the median line of the bottom of the cylinder, one of said entrances, L, being at the top of said cylinder, and the other of the steam-entrances, M, being at the bottom of the cylinder, for the simultaneous admission of steam to the cavity of the cylinder diametrically, but not necessarily longitudinally, opposite each other above and below the axis of the cylinder, to prevent the unequal heating and warping of the cylinder, substantially as described.

2. In combination with the upper dome, L, of the cylinder C C′, and with said cylinder and the storage-tanks O and P, the pressure and exhaust air-pump K, substantially as described.

3. In combination with the cylinder C C′ and the tank O, the pipe o', and the valves o^2 o^3 and intermediate coupling-cock, n', substantially as and for the purposes described.

4. The combination of the cylinder C C′, the perforated pipe *h*, the steam-pipe *s*, boiler H, water-pipe *i*, pump I, and controlling-valves i' s', whereby liquid or steam can be supplied at will to the interior of the cylinder through the perforated floor-pipe either simultaneously or alternately, substantially as and for the purposes described.

5. In combination with the cylinder C C′, the locking-bunter F, substantially as and for the purpose described.

6. The combination of the impregnating-cylinder C C′, provided with the locking-bunter F, and with a railway-track upon its floor, with a series of timber-carriages, each member of which series is provided with wheels which fit and ride upon rails within the cylinder, and with tongues E at one end and transverse beams *e* at the opposite end, whereby the forward member of the series is locked down upon the rails by the engagement of the tongues E with the locking-bunter F, and the following members also locked down by the engagement of the tongues E with the transverse bar *e* of the preceding member, substantially as and for the purposes described.

7. The combination of the cylinder C C′, provided with rails upon its floor, and with the locking-bunter F, with a sectional timber-train, by means of the tongues E and transverse beams *e*, and of the sill-beam E′ of the rear of the last section of the train with the rails by S-hooks *f*, substantially as and for the purposes described.

8. The combination of the tank P, at a greater elevation than the top of the cylinder C C′, with a pipe, p', and dome M, whereby the cylinder may be filled with impregnating-fluid by the aid of gravity, and with an independent water supply and pump, I, whereby pressure may be put upon the contents of the cylinder without passing the impregnating-fluid through the pump, all substantially as and for the purposes described.

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