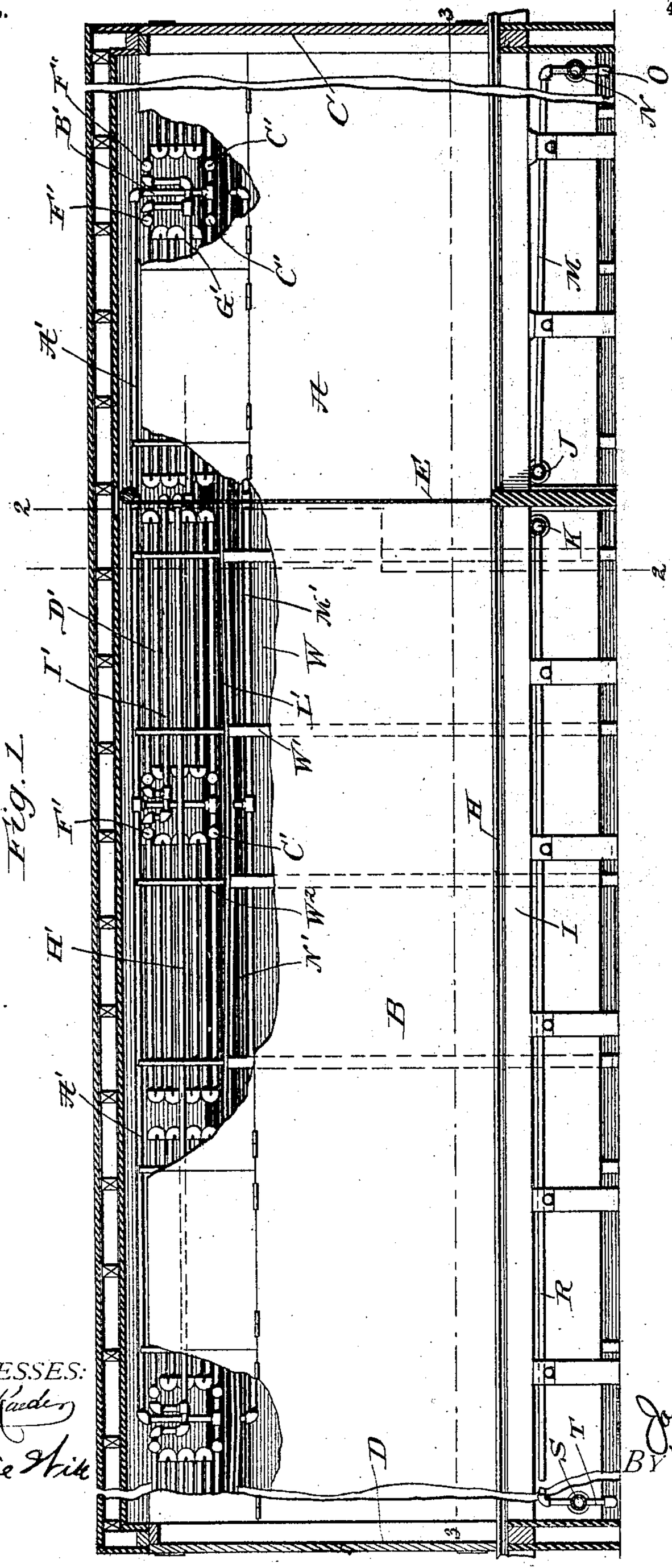
No. 764,583. PATENTED JULY 12, 1904.

J. F. HANRAHAN.

DRYING KILN.

APPLICATION FILED JAN. 23, 1904.

NO MODEL. 4 SHEETS—SHEET 1.



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NO MODEL. 4 SHEETS—SHEET 2.

FIG. 1.

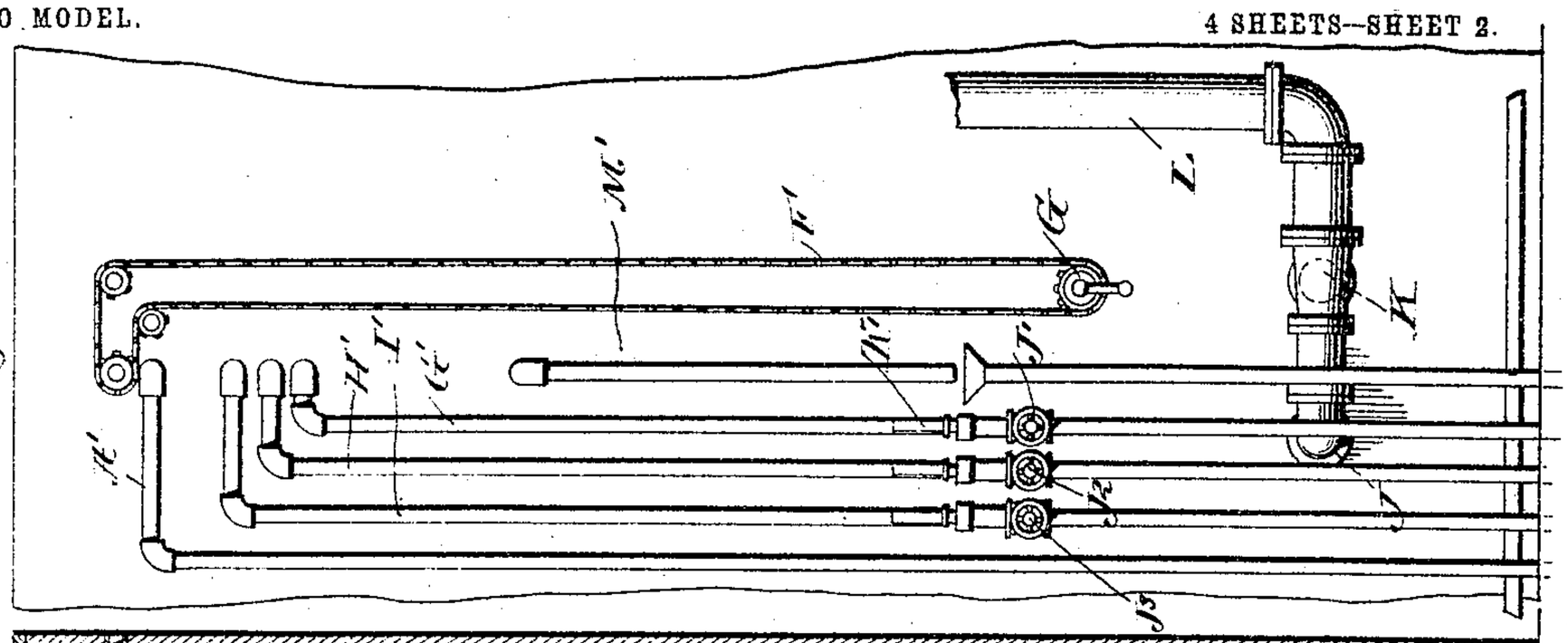
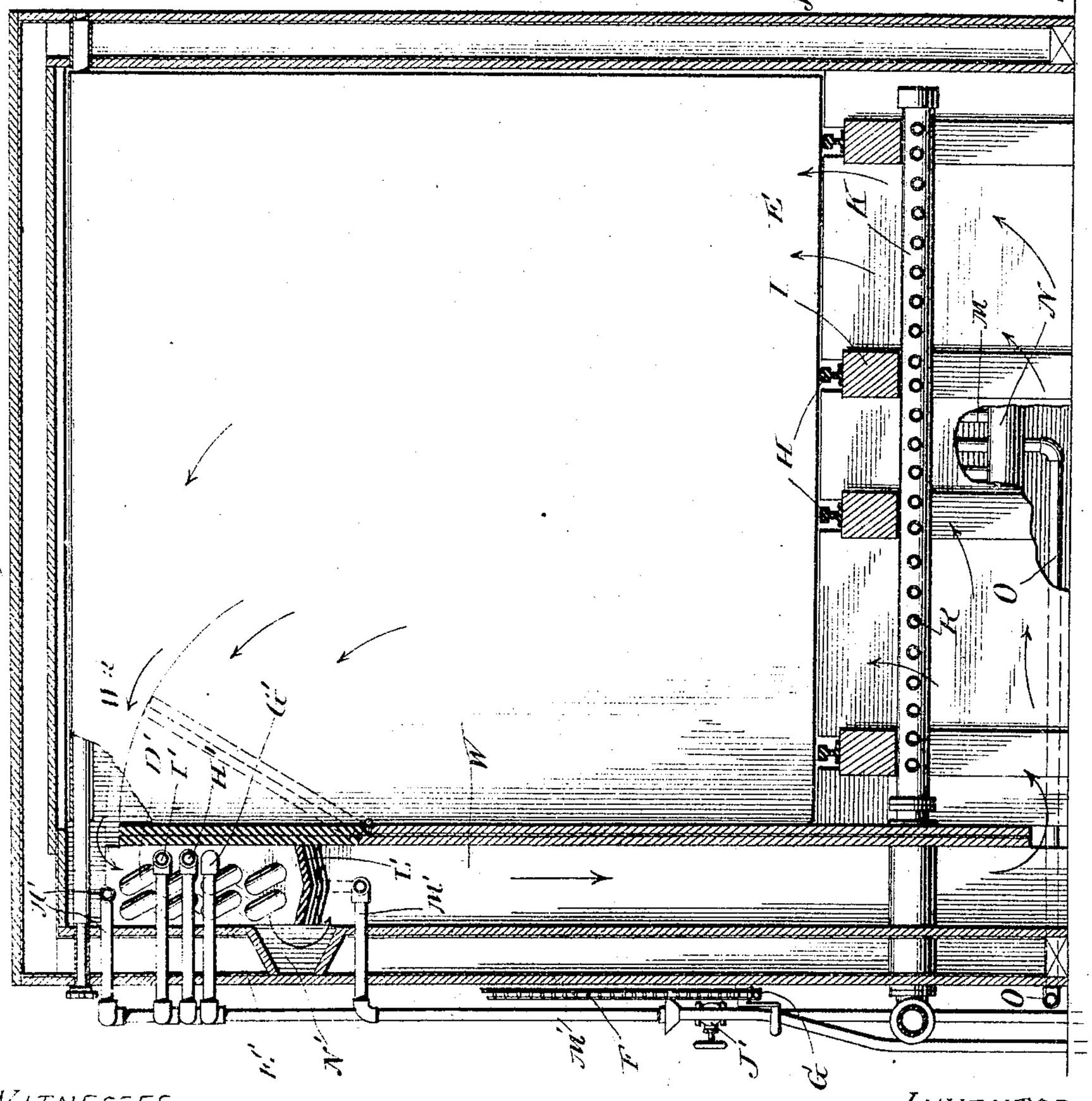


FIG. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

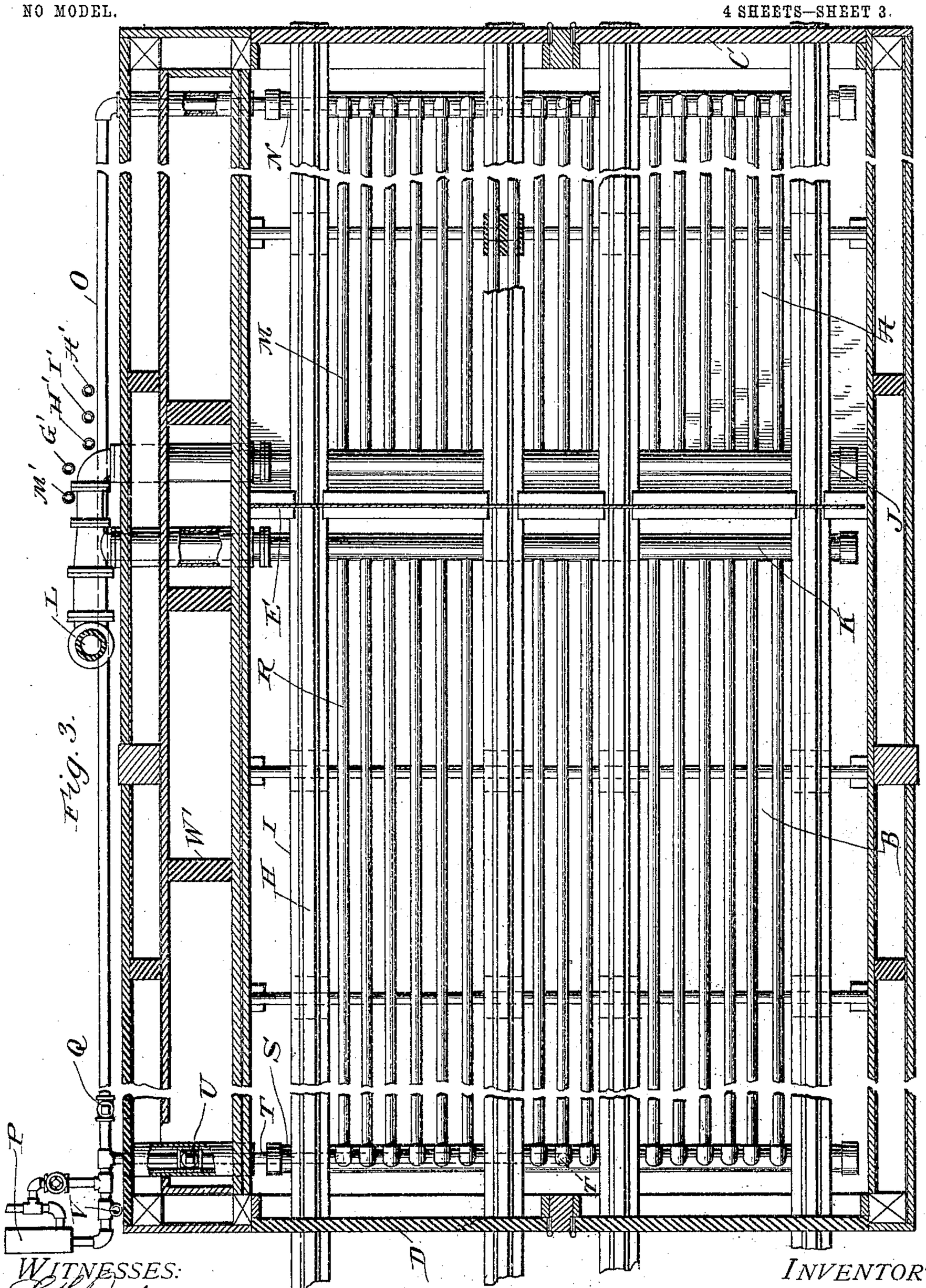

Fig. 3.

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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5.

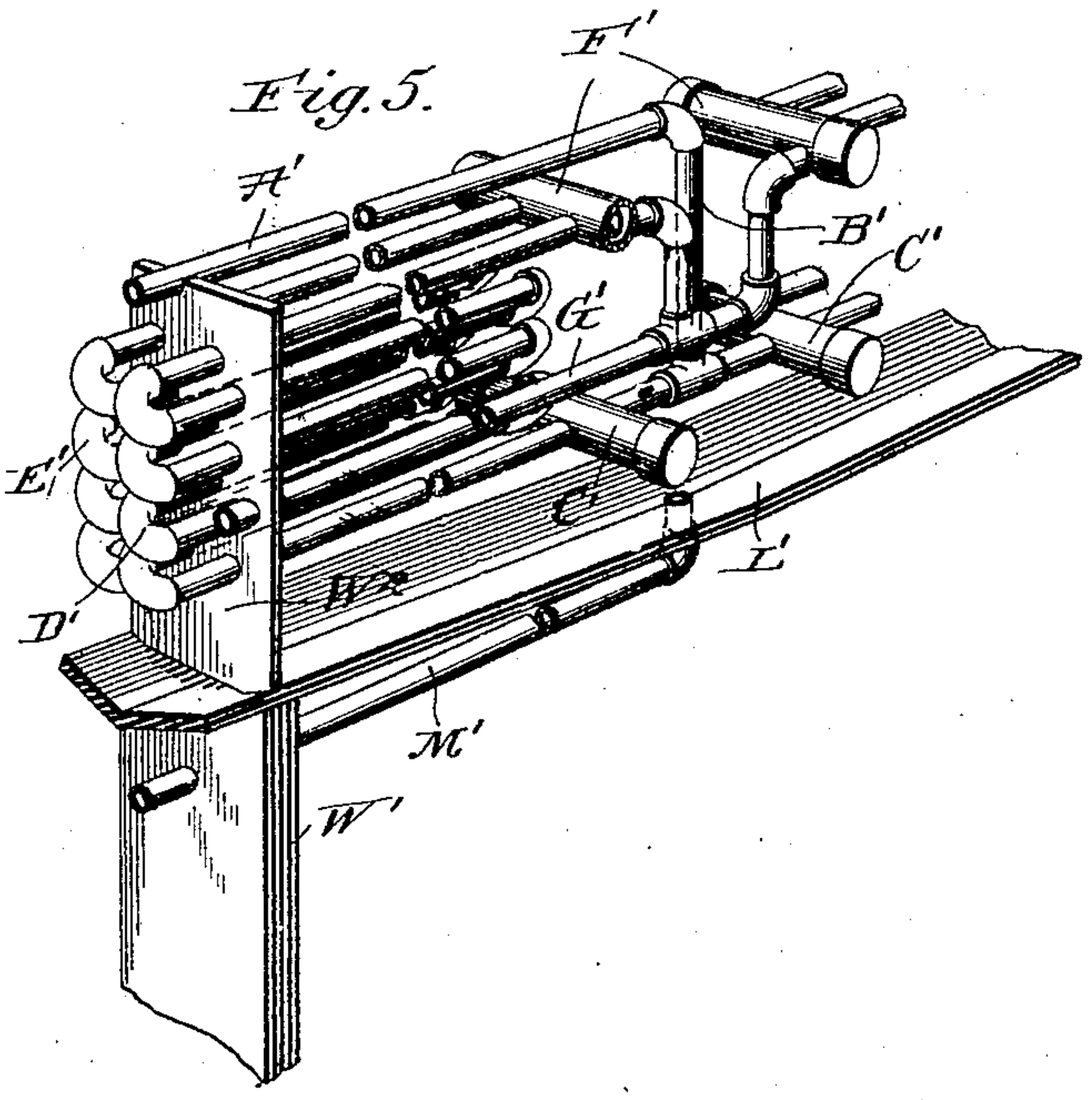


Fig. 6.

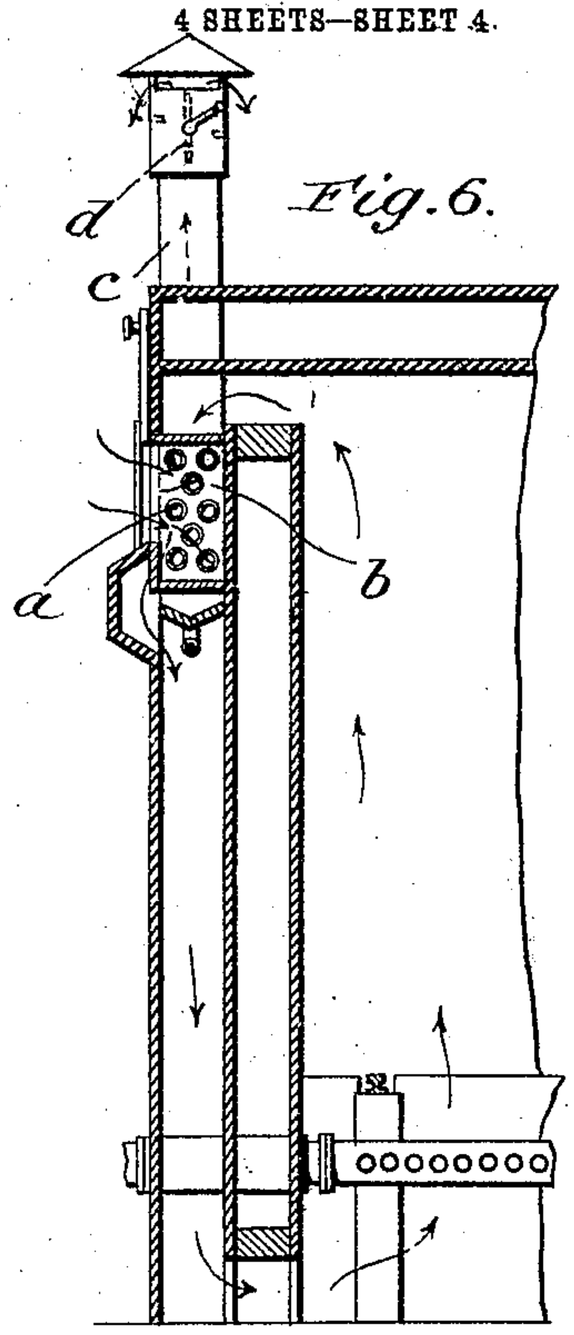
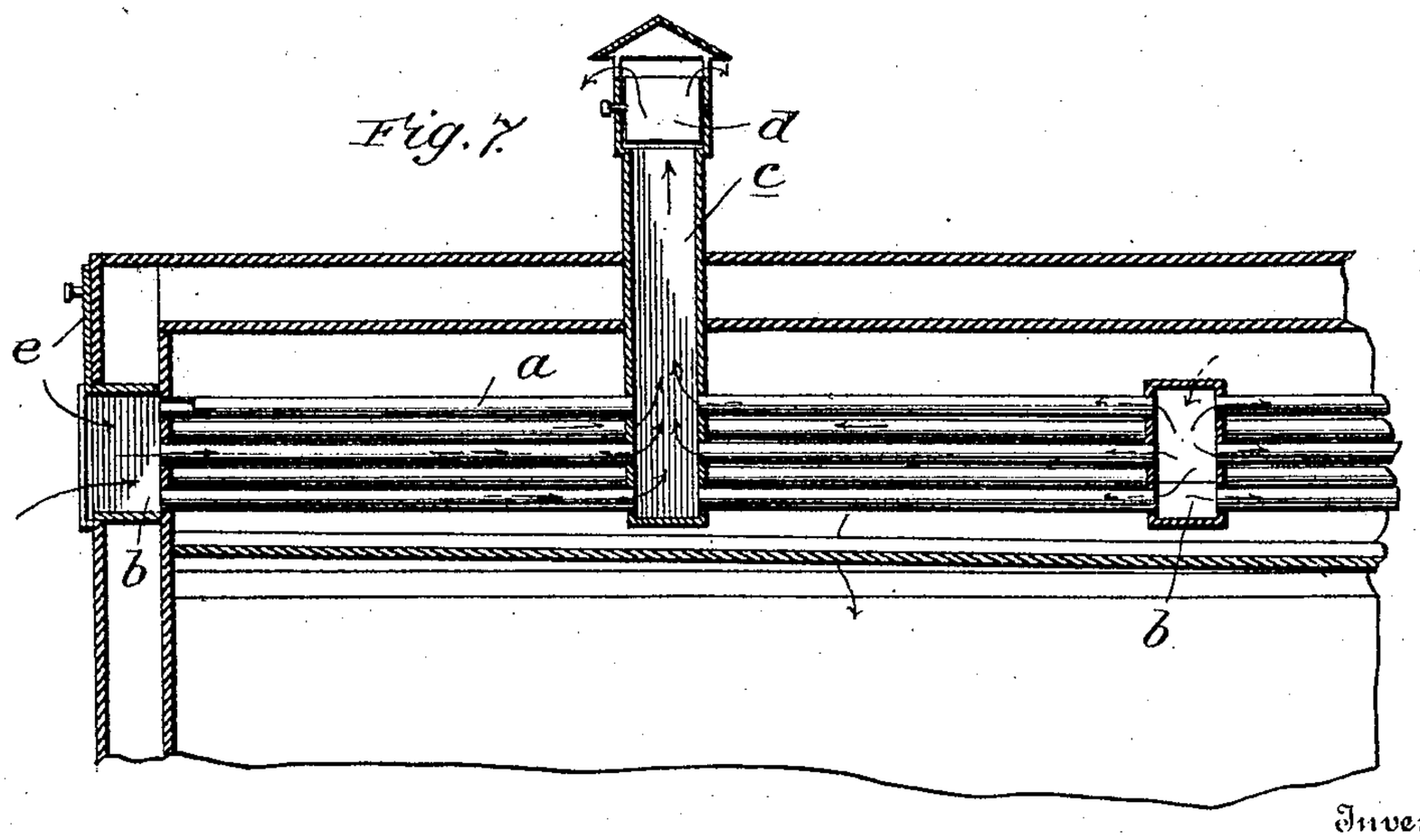


Fig. 7.



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No. 764,583. Patented July 12, 1904.

UNITED STATES PATENT OFFICE.

JOSEPH F. HANRAHAN, OF OTTAWA, CANADA.

DRYING-KILN.

SPECIFICATION forming part of Letters Patent No. 764,583, dated July 12, 1904.

Application filed January 23, 1904. Serial No. 190,335. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH F. HANRAHAN, a subject of the King of Great Britain, residing at Ottawa, in the county of Carleton, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Drying-Kilns, of which the following is a specification.

My present invention relates to improvements in drying-kilns, the construction and advantages of which will be hereinafter set forth, reference being had to the annexed drawings, wherein—

Figure 1 is a longitudinal vertical sectional view of the kiln; Fig. 2, a transverse vertical sectional view on the line 2 2 of Fig. 1; Fig. 3, a horizontal sectional view on the line 3 3 of Fig. 1; Fig. 4, a side elevation showing a portion of the kiln and the means for regulating the passage of the cooling fluid through the manifolds and also means for raising and lowering the curtain which divides the primary drying-chamber from the final drying-chamber; Fig. 5, a perspective view of one of the manifolds; Fig. 6, a sectional view showing a modified form of the invention, and Fig. 7, a longitudinal sectional view of the modified construction.

The main object of the invention is to provide means whereby the temperature of the cooling-coils may be varied to meet changing conditions of the work being performed in the kiln.

A further object is to provide a kiln wherein the material may be given a preliminary heating and drying and then passed into another portion of the apparatus, where it may be finally dried, the degree of moisture extracted in the two sections of the kiln being varied according to circumstances.

The general construction of the kiln is similar to that shown and claimed in Letters Patent of the United States granted to me under date of November 26, 1901, and numbered 687,305, the present invention differing from that described therein principally in that two chambers are employed in the kiln, namely, a primary or sweating chamber and a secondary or final drying-chamber, and means are provided for controlling the temperature in the various condensing or cooling coils.

Referring first to Figs. 1 to 5, inclusive, A denotes the primary or sweating chamber, and B the final drying-chamber. A door C is provided for the sweating-chamber, and there is an exit D at the opposite end of the drying-chamber. A curtain E separates the two chambers, said curtain being secured upon a roll mounted in the upper portion of the kiln and manipulated in any suitable manner—as, for instance, by an endless chain F, passing over sprockets and operated by means of a windlass or wheel G. These parts are located upon the exterior of the kiln, so that the curtain may be raised at any time without the necessity of an attendant passing into the kiln or the exterior door thereof being opened. Rails H extend throughout the length of the kiln, being supported upon timbers I. Manifolds J and K, the former located beneath the timbers in the sweating-chamber and the latter below the timbers in the large or final drying-chamber, are connected with a steam-supply pipe L. Pipes M extend from the manifold J to another manifold N, located at the opposite end of the sweating-chamber, to which in turn is connected a drain-pipe O, passing outside of the kiln and being connected to a trap P. A check-valve Q of any suitable construction will be interposed in the pipe O, between the manifold and the trap. A series of pipes R extend from the manifold K to another manifold S, mounted in the opposite end of the large drying-chamber, said manifold being provided with a drain-pipe T, which is connected with the pipe O, intermediate the check-valve Q and trap P. A check-valve U, Fig. 3, is placed in the pipe T. An exhaust-pipe V is connected with the return-line and extends above the roof or to such other point as may be found desirable. The manifolds serve to heat the air in the lower portion of the kiln, as is well understood by those skilled in the art, and the heated air rising will pass over into a condensing-chamber located at one side of the kiln. The condensing-chamber, as in my former patent, is open at the top and also at the bottom, so that the heated air with the contained moisture enters the upper portion thereof, and coming into contact with the condensing-coils is deprived of its moisture and cooled. The air will then,

of course, fall to the lower portion of the chamber W and pass out through the opening which is at a point below the heating-pipes.

In the construction shown I have provided means for regulating the temperature of the condensing-coils. In the sweating-chamber it is essential to the proper drying of the lumber that it be heated throughout in order that the moisture may be extracted from all portions of the material, and consequently it is necessary that the condensing-coils be relatively warmer than those in the final drying-chamber. Being warmer they will not, of course, take as much moisture from the air. In the present construction I provide a main supply-pipe A′, which extends from the source of supply and passes into the upper portion of the condensing-chamber, running practically throughout the entire length of the kiln, as best shown in Fig. 1. This pipe is provided with a series of laterals B′, which in turn are connected with manifolds C′. Coils D′ E′ communicate at their lower ends with the manifolds C′, the upper ends thereof being connected to manifolds F′. A return-pipe G′ is joined to the manifolds F′ F′ in the sweating-chamber, while return-pipes H′ and I′ are connected to the manifolds F′ in the condensing-chamber of the large or final drying portion of the kiln. Valves J′, J², and J³ are provided for pipes G′, H′, and I′, so that the flow of water through the pipes may be retarded or regulated as desired. In order that the temperature of the water passing from the coils may be ascertained, the pipes G′, H′, and I′ are provided with thermometers K′, as indicated in Fig. 4. The use of thermometers in connection with the valves will enable the attendant to so regulate the temperature of the coils as to condense more or less of the moisture carried over into the condensing-chamber by the heated air, and in this manner regulate the action of the kiln.

As is well understood, in drying lumber it is desirable that the moisture be removed very slowly from the air in the sweating-chamber, so that the wood may become heated throughout and the pores on the outer surface prevented from being prematurely dried, thus sealing the pieces against further evaporation from the interior. In the large or final drying-chamber it is of course desirable to extract more of the moisture from the heated air, and while the amount evaporated may be less at the beginning of the operation in said chamber as much moisture as possible is withdrawn during the final step of drying.

Suitable pans L′ will be located beneath the condensing-coils, said pans being drained by pipes M′, which extend to a point outside the wall of the kiln, as best indicated in Figs. 2 and 4. Inasmuch as the pans extend throughout the width of the condensing-chamber, a by-pass or recess N′ is formed at one side thereof in the wall of the kiln, whereby the cooled air may readily pass from the coils to the lower portion of the condensing-chamber. The form of the by-pass is immaterial. It will vary with different kilns, being adapted in each case to the particular construction of apparatus employed.

It is, of course, to be understood that any cooling fluid or agent—such as cold water, brine, ammonia, &c.—may be forced through the various cooling-pipes. In Figs. 6 and 7 a modification of the invention is shown, wherein air is to be employed as the cooling medium, which passes through the condensing-pipes. A series of pipes *a* is mounted in the upper portion of the condensing-chamber, said pipes opening at one end into a box or chamber *b*, into which air may pass. The opposite ends of the pipes are connected to a flue or ventilator *c*, a suitable valve or damper *d* being provided to regulate the flow of air therefrom, and consequently through the pipes *a*. A damper *e* may also be employed to control the inflow of air to the pipes *a*, and in this manner the temperature of the condensing-coils may be regulated as desired. It will of course be understood that a forced draft may be employed.

While the kiln is in operation it will be closed to the external atmosphere, so that the same air is used over and over again, being heated, passed through the material being dried, (from which it extracts moisture,) and then cooled, whereby the moisture carried by the heated air is condensed and withdrawn from the air, which again passes up through the material being treated. This action, as is well understood, is automatic, there being no necessity for the use of any forced draft or blowers.

The condensing-chamber is practically divided by the upright studs W′, Fig. 3, which are employed in building up the structure. Furthermore, the plates W², which support the coils, divide the condensing-chamber into a series of smaller condensing-chambers. In this way the air which passes out of the sweating and drying chambers cannot commingle.

The height or elevation of the heating-coils from the floor or bottom of the kiln is dependent upon the width of the kiln. When the same is narrow, the pipes may be relatively low and the opening from the condensing-chamber close thereto, while, on the other hand, if the kiln be wide the pipes must be higher, in order that the cooled and dried air may pass from the condensing-chamber to the extreme side of the kiln. By observing these conditions the cooled air may be properly distributed before it comes under the influence of the heating-coils. The proper distribution of the cooled air beneath the heating-coils prevents eddies in the drying-chamber and subjects the entire charge in the kiln to the same conditions.

Having thus described my invention, what I claim is—

1. In a drying-kiln, the combination of a primary drying-chamber; a final drying-chamber; a condensing-chamber for each of said primary and final drying-chambers; a condenser mounted in each of said condensing-chambers; and means for regulating the temperature of said condensers.

2. In a drying-kiln, the combination of a drying-chamber; heating means located near the bottom thereof; a condensing-chamber in communication with the upper and lower portions of said drying-chamber; a series of condensing-coils located in said condensing-chamber; a supply-pipe leading to said coils; a series of return-pipes leading from the coils; a valve located in each of said return-pipes outside of the kiln, for controlling the flow of cooling medium therethrough; and a thermometer also located in each of said return-pipes outside of the kiln, whereby the temperature of each of the coils may be determined and controlled from without the kiln, substantially as and for the purpose described.

3. In a drying-kiln, the combination of a drying-chamber; heating means located near the bottom thereof; a condensing-chamber in communication with the upper and lower portion of said drying-chamber, said condensing-chamber extending throughout the length of the kiln; a series of condensing-coils disposed throughout the length of said condensing-chamber; supply and exhaust manifolds connected to the ends of said coils; a supply-pipe connected to the supply-manifolds; return-pipes, one for each coil, connected to the exhaust-manifolds; a valve located in each of said return-pipes, said valves being located outside of the kiln; and a thermometer also located in each of said return-pipes in view of the attendant, whereby the temperature of the coils may be regulated as desired without the necessity of the attendant entering the kiln.

4. In a drying-kiln, the combination of a drying-chamber; heating means located near the bottom thereof; a condensing-chamber extending longitudinally of the kiln, said chamber communicating with the upper and lower portions of the drying-chamber; a series of condensing-coils disposed in said condensing-chamber throughout the length thereof; and means located exteriorly of the kiln for determining and regulating the temperature of said coils independently of each other, substantially as described, whereby the temperature in the various portions of the kiln may be varied and regulated according to the requirements of the material undergoing treatment.

5. In a drying-kiln, the combination of a drying-chamber; heating means located near the bottom thereof; a condensing-chamber extending lengthwise thereof, said condensing-chamber communicating with the upper and lower portions of the drying-chamber; a series of condensing-coils disposed in said condensing-chamber throughout the length thereof; a general supply-main; connections extending from said main to each coil, an independent return from each coil; and means located in said returns exteriorly of the kiln for determining and regulating the temperature of the cooling medium passing therethrough.

6. In a drying-kiln, the combination of a sweating-chamber; a final drying-chamber; a curtain separating said chambers from each other; means operated from without the kiln for raising and lowering said curtain; a condensing-chamber for the sweating-chamber; condensing means mounted in said condensing-chamber; means for controlling the temperature of said condensing means; a condensing-chamber for the final drying-chamber; condensing means mounted in said condensing-chamber; and means for controlling the temperature of said condensing means.

7. In a drying-kiln, the combination of a drying-chamber; heating means located near the bottom thereof; a condensing-chamber in communication with the upper and lower portions of said drying-chamber; a series of condensing-coils located in said condensing-chamber throughout the length of the kiln; and means for independently controlling the temperature of said coils.

8. In a drying-kiln, the combination of a drying-chamber closed to the external atmosphere; heating means located near the bottom thereof; a condensing-chamber in communication with the upper and lower portions of said drying-chamber; a condenser located in said condensing-chamber and occupying substantially the entire width thereof; a pan located beneath the condenser, said pan being of a width equal to the width of the condenser; and a by-pass located to one side of the pan, substantially as described.

9. In a drying-kiln, the combination of a primary drying-chamber; a final drying-chamber; a condensing-chamber for each of said drying-chambers; a condenser mounted in the condensing-chamber of the primary drying-chamber; means for controlling the temperature thereof; a series of condensing-coils located in the condensing-chamber of the final drying-chamber; and means for independently controlling the temperature of said coils.

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

JOSEPH F. HANRAHAN.

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