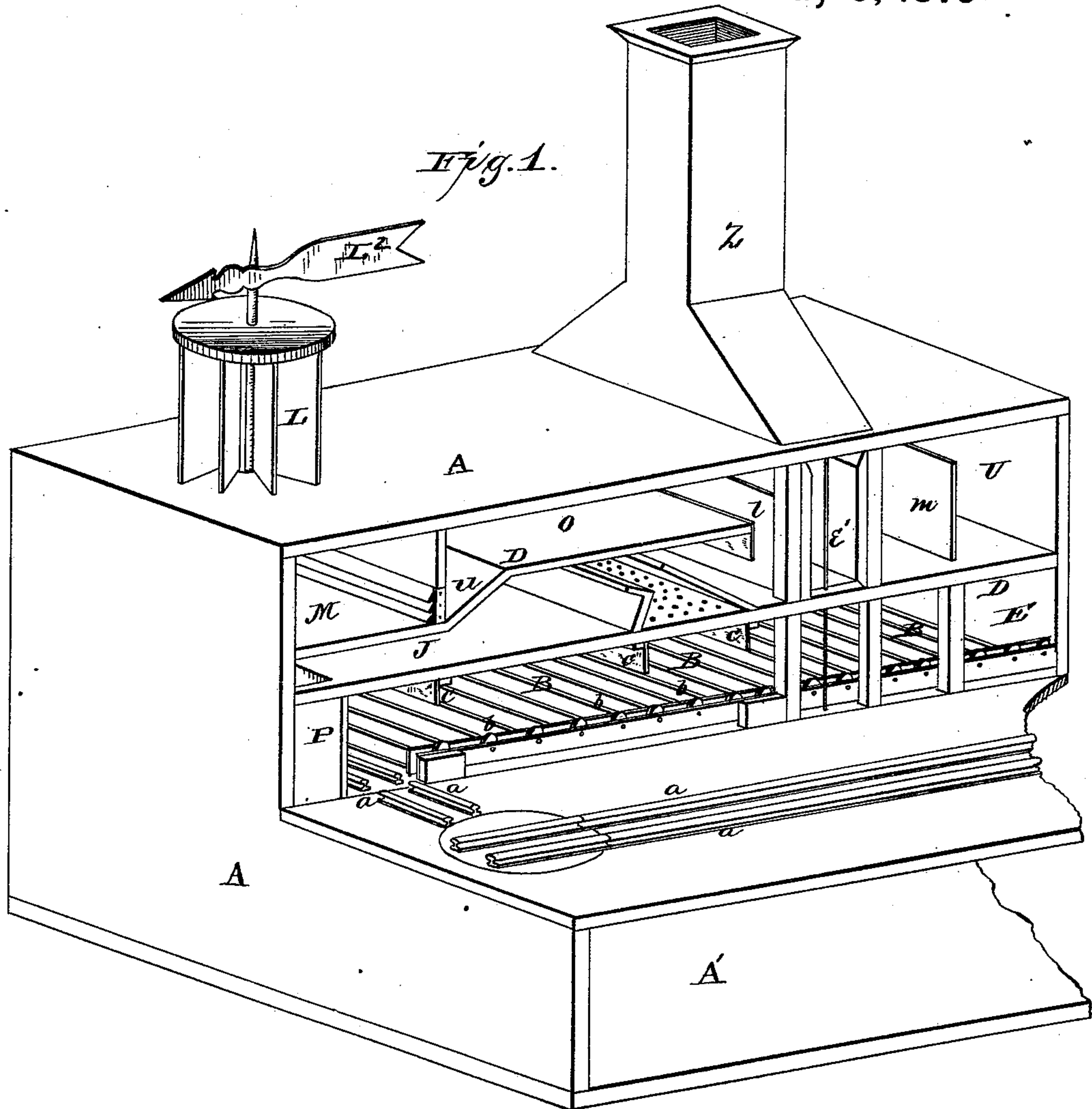


C. WILCOX.
Steam and Hot Air Kiln for Drying Lumber, &c.
No. 215,193.
Patented May 6, 1879.



WITNESSES

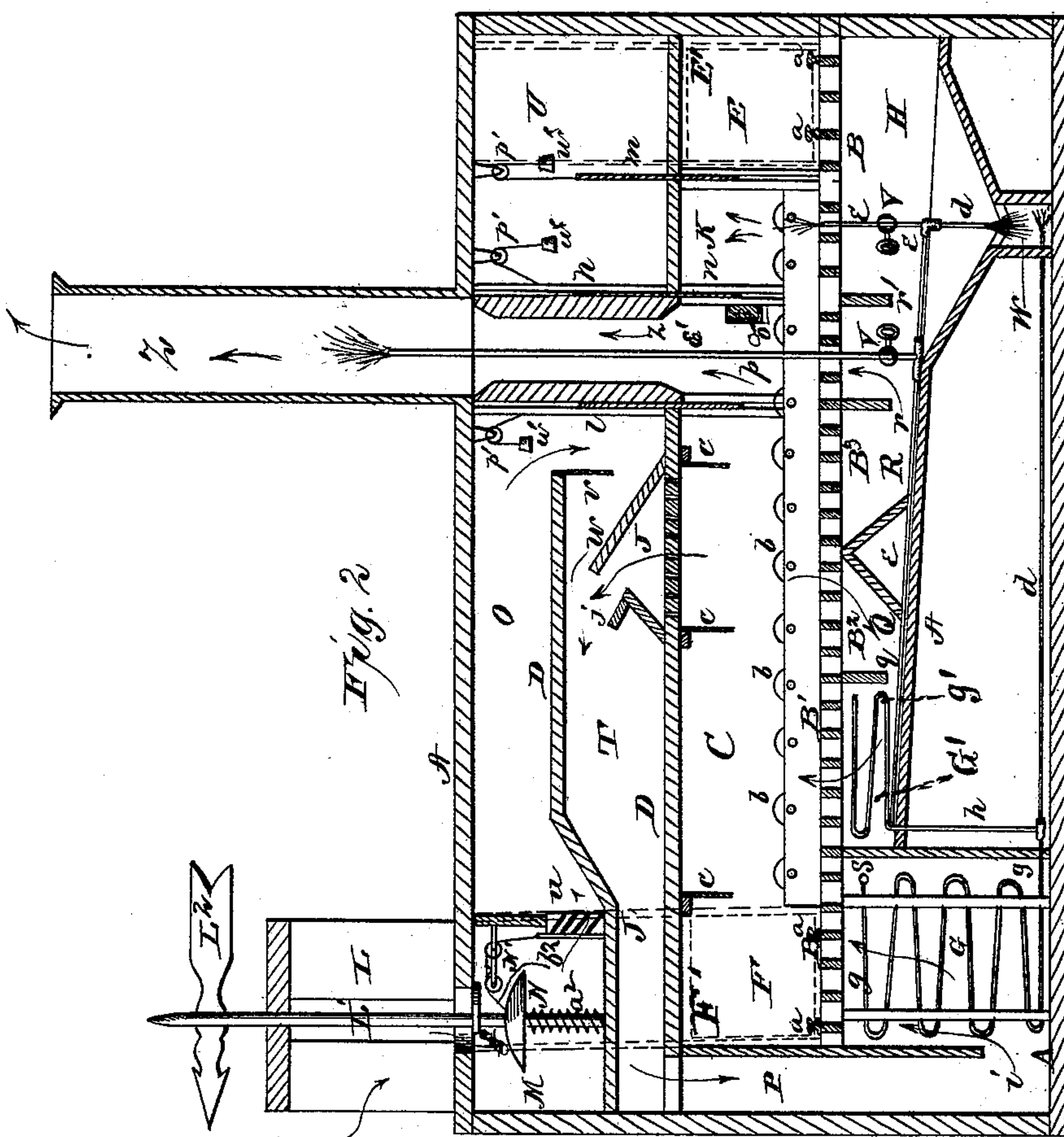
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Fig. 5.

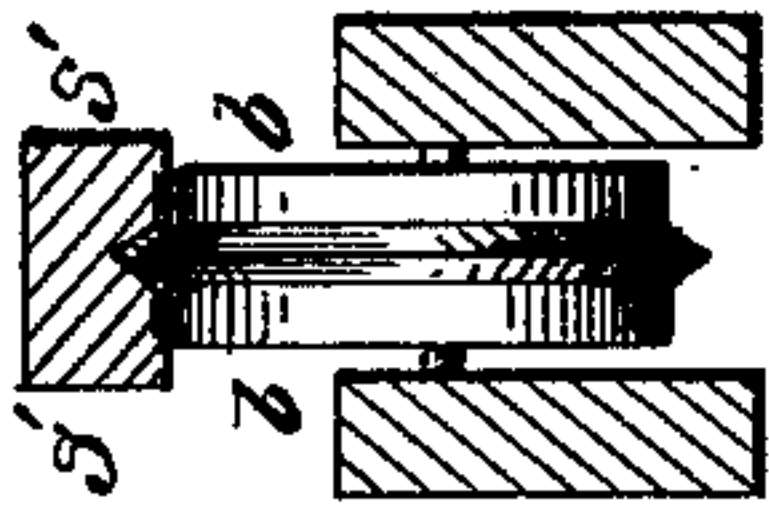


Fig. 3.

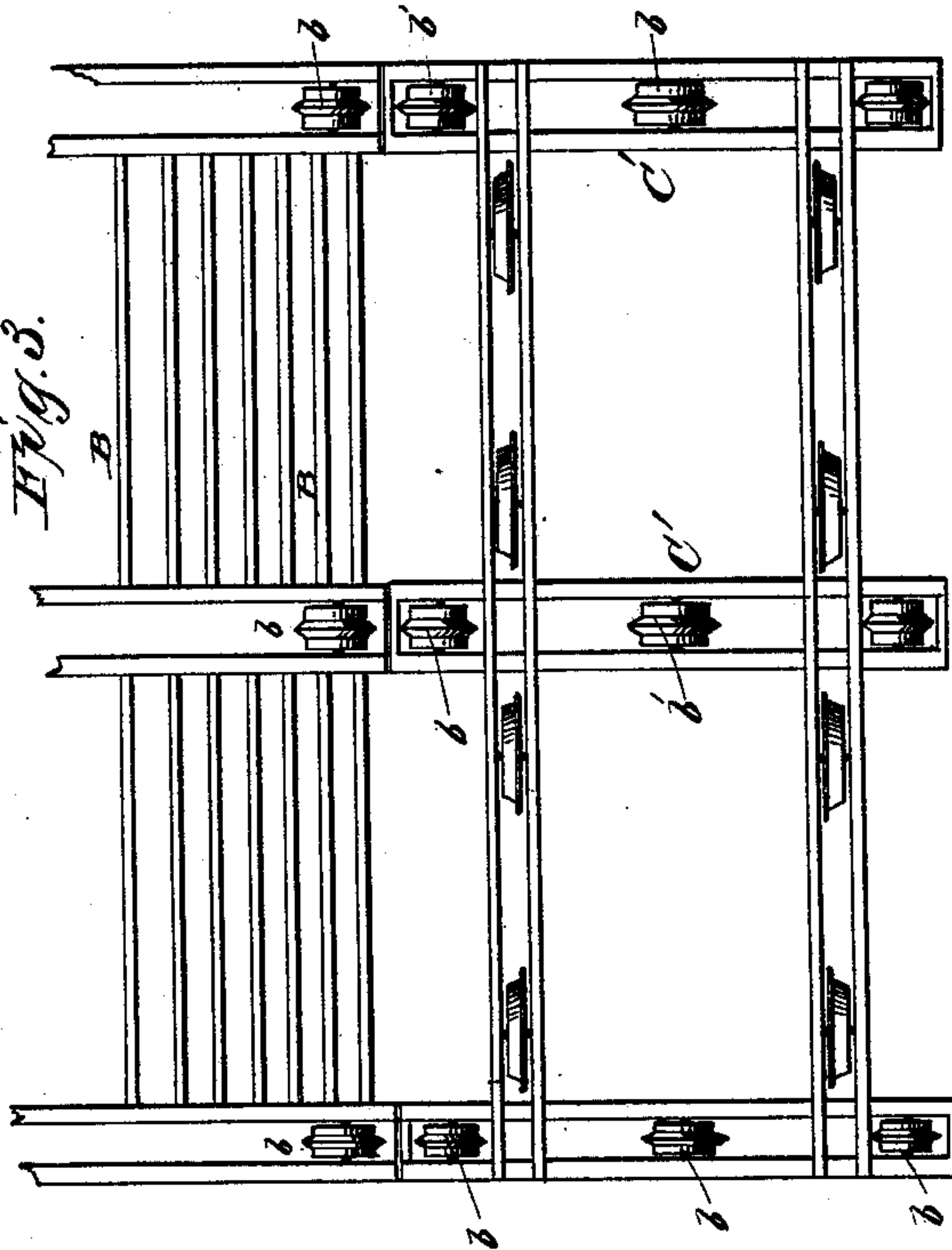
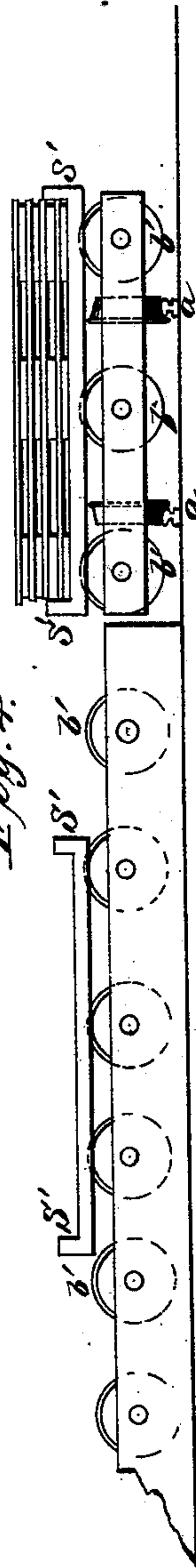


Fig. 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

CARLOS WILCOX, OF MINNEAPOLIS, MINNESOTA.

IMPROVEMENT IN STEAM AND HOT-AIR KILNS FOR DRYING LUMBER, &c.

Specification forming part of Letters Patent No. **215,193**, dated May 6, 1879; application filed March 13, 1879.

To all whom it may concern:

Be it known that I, CARLOS WILCOX, residing in the city of Minneapolis, in the county of Hennepin, and in the State of Minnesota, have invented certain new and useful Improvements in Steam and Hot-Air Dry-Kilns for Drying Lumber and other Materials; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

My invention comprises the novel construction and arrangement of the several essential parts of a drying-kiln, more particularly adapted to steaming and drying green and wet lumber, but applicable also for drying other materials.

The invention relates to a steaming-department and a drying-department.

It also relates to and includes new methods of circulation and exhaustion.

It also embraces new devices for introducing the lumber or other material to be dried into the kiln, and for conveying the same through the kiln, and for removing the same when dried.

All the methods heretofore practiced for the artificial drying and seasoning of lumber are not only inconvenient and expensive, but most of them are unscientific in principle and impracticable in operation, while some of them are positively injurious to the lumber, and are in themselves extremely hazardous by reason of great exposure and liability to take fire.

The various methods of steaming lumber alone, as practiced by many, have no merit or advantage in them over the ordinary yard drying process. The lumber is not at all dried or seasoned by the steam-bath alone. It must therefore be hauled to the yard and stuck up in the usual manner to dry. The little time saved in seasoning which is claimed for this method will in no degree compensate for the extra labor and expense in handling.

There are a variety of other kilns in use in which either the products of combustion or direct furnace heat are made the heating and drying agency, all of which are injurious to

the lumber, and sooner or later they take fire and burn down.

There is still another class of driers, comprising a great variety of styles, in which steam is employed as the heating agency. Most of these are found to be so faulty in the principles upon which they are constructed and operated as to be of no practical value. A few only of this class possess any real merit and have been successfully introduced and operated; and yet the best of these even have developed in themselves elements of great inconvenience and impracticability. They also exhibit features positively unphilosophical and unscientific in their construction and in their methods of circulation and ventilation.

The object of my invention, therefore, is to combine and improve all the good features of other dry-kilns, carefully avoiding and overcoming their errors and defects. In other words, my aim and purpose has been to provide a safe and more complete system, and a more practical and economical system, of steaming and drying lumber, combining therewith the simplest and best mechanical devices for moving and transferring the lumber, and the most correct and scientific principles of circulation or of ventilation and exhaustion.

My invention, as herein described, though specially adapted to drying and seasoning lumber, is not necessarily confined to this purpose. It is applicable also to most other purposes for which driers are used.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to describe its peculiar construction and operation, referring to the annexed drawings, in which—

Figure 1 is a perspective view, representing some of the novel features of my improved drier, one side of the kiln being left out of the drawings in order to show better the interior arrangement and construction, and to give a better idea of the ventilating devices, and of the devices employed for conveying the lumber or other materials to be dried. Fig. 2 is a longitudinal vertical section of the same. Fig. 3 is a horizontal sectional view, showing a transfer-car and a portion of the inclined grated

bottom separating the heating and drying chambers, and over which the lumber is conveyed through the kiln by means of the stationary wheels. Fig. 4 shows an end view of a transfer-car with a partial load of lumber piled transversely upon the grooved slides or gliders, which rest upon and glide along over the mounted wheels. It also shows a vertical side section of the stationary wheels, to which the gliders with their freight are transferred from the car. Fig. 5 shows an end view of one of the three rows of stationary wheels, with the grooved slide or glider resting on the wheels in position for carrying the load.

A A represent the outside walls and roof of the building, forming the shell of the kiln, and A' A' are the foundations of the same.

B is the inclined bottom of the drying-chamber and the steaming-apartment, separating the same from the basement-rooms below, forming the heating and exhaust chambers. This bottom is simply an open wood grating, to allow free circulation of the currents of air through the same, as shown by the arrows, and extends from one end of the kiln to the other.

C is the drying-chamber, where the lumber or other material to be dried is subjected to the currents of hot air, and through which it is made to pass on cars of peculiar and suitable construction, or by means of other equivalent devices, in an opposite direction to the arrows indicating the hot-air currents.

D is the ceiling of the kiln, running parallel with the grated floor or bottom B, and both of which are inclined from E to F about three feet in one hundred feet.

E is an opening in the side wall of the kiln, near one end, provided with a sliding door, E', suitably hung, and through which the lumber or other material to be dried enters the kiln upon transfer-cars.

F at the other end of the kiln is where the drying process is finished, and where the dry lumber or other material is withdrawn from the kiln upon transfer-cars, through another side opening with sliding door F', similar to E'.

Over the floor or grating at the entrance E and exit F are laid iron T-rails *a a*, over which the transfer-cars are run in passing in and out of the kiln.

b b are stationary cast-iron center-flanged wheels, arranged in two, three, or more rows, but usually in three rows, along the inclined bottom from E to F—one through the center of the kiln, and one on either side, about six or eight inches from the walls. Over these wheels the loads of lumber or other material to be dried, resting upon and carried by the grooved slides or gliders *S'*, are easily pushed and rolled along down the inclined plane through the kiln from the transfer-cars at E to the same at F, the construction, arrangement, and working of these devices for moving and transferring the lumber or other ma-

terial being better shown in Figs. 3, 4, and 5, and hereinafter more fully explained.

Along the ceiling and across the kiln, at intervals of about twelve feet, short curtains *cc* are attached, depending about twenty-four to thirty inches, sufficient to reach and rest upon the piles of lumber or other material while passing through the drying-room, the function of which is to deflect the hot-air currents rushing along the ceiling to a lower plane, and forcing the same to seek a passage through the lumber or other material to be dried.

G and G' are the heating-chambers, containing the gates or coils *g* and *g'* of steam-pipe, by which the air is heated. These coils may be constructed and arranged in the chambers in any approved manner found most practical, economical, and convenient. The supply of steam from a boiler or working engine in proximity to the kiln may be introduced into the chamber G at any point also found most economical and convenient, either above or below ground, as shown at S.

The steam first enters the coils *g* at the top of the chamber G, and having been equally and properly distributed through the coils, it passes from the chamber G at the bottom through the pipe *h* into the chamber G', and enters the coils *g'* at the top, and is in like manner equally and properly distributed through the same, and finally is exhausted at the bottom through the pipes *ee*, by which it is carried into the exhaust-cellar H, and upward through the same to the bottom of the steaming-apartment K, where the steam is discharged, for the purpose of steaming all green and wet lumber when first introduced into the kiln.

All water proceeding from condensation of steam in the supply-pipe S, the coils *g* and *g'*, and pipes *ee* is drawn off by the drip and drain pipes *dd* and discharged into the well W. Whenever it is deemed advisable not to operate the steaming-department, as may sometimes be the case with partially-seasoned lumber, the steam may be turned off by means of the valves V V, and discharged into the chimney through the exhaust-pipe *e'*, where it is drawn up and carried off with the foul air from the kiln. This exhaust-pipe *e'* may be carried up the stack to discharge the steam at any elevation desired.

In the construction of my dry-kilns for the manufacture of starch, glue, and many other commodities, and for drying clothes, hides, tobacco, wool, and many other articles where steaming is not requisite or is not practiced, the steaming-department may be altogether omitted in the plans for the same, and some changes in the size and form of the kiln, and in the style of carriage for moving the materials to be dried in and out and through the kiln, may be found advisable, and even necessary, to better suit the particular purpose for which the drier is intended. But while admitting this, I claim that the aero-dynamical opera-

tions and effects of my invention are equally applicable to all forms and kinds of driers, and would be the same applied in each; and the manner of my applying steam for heating purposes, and of reheating the air of the kiln, and of circulating and exhausting the same, is equally applicable also to all forms and kinds of driers, whether for lumber or otherwise.

L represents a device which I have denominated "the aerial or atmospheric blower," a sort of wind-catcher or natural air-receiver, which gathers in, concentrates, and compresses the air from whatever direction it may come, the dynamic force of which carries a continuous volume of air down the throat and through the valve *f* into the receptacle M, from whence it is discharged by an automatic regulator, N N', through the opening or grating *u*, into the upper air-chamber, dry-room, or store-room, O, and from thence it is driven under the apron or curtain *v*, and over the hood *w*, into the middle chamber, dry-room, or store-room, T, where it mingles with the hot air rising through the escape J, and both together are driven on through the air-passage J', and down the passage P and through the opening *i* at the bottom, when it is delivered into the heating-chamber G. Here the air comes in contact with the steam-coils *g*, and, being heated, rises, and is delivered into the drying-chamber C through the open or grated bottom B.

By the aero-dynamic propulsion of the air into the chamber G, assisted also to mount upward by the heating agency of the steam-coils *g*, the hot air in the chamber C is pushed forward under the curtains *c* through the piles of lumber or other material being dried, the movement and circulation of the same being all the while further aided and assisted by the suction of the hot-air escape J, the action of the steam-coils *g'*, and the natural draft of the chimney Z. A portion of air from the center of the drying-chamber C falls through the grating at B² into the returning-chamber Q, and is drawn through the opening *q* into the reheating-chamber G', and, there passing through the steam-coils *g'*, is reheated, and rises again through the grating into the drying-chamber.

By this returning and reheating device a constant hot-air circulation is easily maintained in the central and lower portions of the drying-chamber, by means of which all damp and foul air is removed therefrom, and the bottom courses of lumber or other material are as well dried and seasoned as the top, which is not the case in most other kilns.

Another portion of air from the drying-chamber C—namely, that moving along the ceiling and directly under the curtains *c*, and therefore the hottest portion—is drawn up through the hot-air escape J, partly by the natural lightness and elasticity of the hot air, and partly by the suction at the orifice *j*, caused by the blast of cold air from the at-

mospheric blower or wind-receiver L, and both currents, moving in the same direction, necessarily commingle and pass on together, as above shown, down into the heating-chamber G.

By this device a great saving of hot air is made which otherwise would be lost, and the high temperature of the kiln is more easily maintained.

The air is thus delivered into the heating-chamber at a warm temperature, thus avoiding all danger of freezing up the steam-coils, even in most extreme cold weather—a very serious difficulty attending the operation of most other steam dry-kilns.

It is therefore only the cold, damp, foul and heavy air of the kiln which is left to fall through the grating at B³ into the air-sink R, from whence it may be expelled by a suction-fan; or it may be drawn out through the opening *r* into the base of the chimney Z, and carried off by the natural draft of the same.

The hot-air escape J is made by perforating the ceiling at this point, or by making an opening, or by inserting a grating, say about six feet wide and extending across the kiln. It may be covered by a sort of hood or wing, *w*, placed at such an angle with the ceiling as to direct the current of hot air toward the passages J' and P at the other end of the middle chamber. This wing *w* also directs the current of cold air perflated from the blower L toward the ceiling or floor D', dividing the upper and middle air-chambers or dry-rooms, by which means the hot air rising from J is also driven along and mingled and blended with the cold air in its passage on and down to the chamber G.

The air, as is already seen, is perflated by the aerial or atmospheric blower L into and through the several chambers and air-passages of the kiln to the heating-chambers, and from thence through the drying-chamber on a slightly-rising grade from F toward E, till, striking the transverse vertically-sliding door *l*, it falls naturally into the sink R, and from thence is swept into the base of the chimney, and by it carried away.

The lumber or material to be dried, on the other hand, enters at E and moves through the kiln toward F, being in an opposite direction to the hot-air currents, and is therefore all the while gradually approaching warmer and hotter portions of the kiln.

The lumber is transferred from the cars at E to the steaming-apartment K, and when steamed sufficiently is moved on into the chamber *p*, where, standing in the draft of the chimney, it is allowed to sweat, drip, and cool off until another load is steamed and ready to take its place. It is then moved on into the drying-chamber C, and, slowly and gradually approaching the hot end F, is removed therefrom by transfer-cars, in about four or five days' time, in a thoroughly dried and well-seasoned condition.

Steam-jets may be attached to the pipes or coils $g g'$, to allow a limited amount of steam to enter the drying-chamber at and near the hot end, for the purpose of modifying the dry hot air and keeping the surface of the lumber moist and soft during the drying process, thus keeping the surface and ends of the lumber from drying and shrinking too rapidly, thereby avoiding the checking, warping, and straining of the lumber so much complained of in other kilns.

The side doors, $E' F'$, may be arranged and hung to slide longitudinally and horizontally, or vertically by means of suitable weights, wire cable, and pulleys or sheaves.

The transverse vertically-sliding doors $l n m$ may be made of dry thin lumber, or they may consist of a wooden sash or frame-work, filled in or covered with sheet-iron or heavy canvas, and be so hung and balanced with wire ropes, weights, and pulleys as to be easily raised and lowered at pleasure. They form, in part, the walls of the steam-bath room K , and of the sweating and dripping or cooling room p , and are raised up into the chambers T , O , and U , to allow the loads of lumber or other material to be transferred from the cars at E into the bath-chamber K , and from thence into the chamber p , to sweat, drip, and cool off in the draft of the chimney, and from thence into the drying-chamber C . A wicket, o , is made in the wall to give access to the chamber p , for the convenience of the workmen in manipulating the sliding doors, and in moving the loads of lumber on through the kiln. Another wicket should be made in the wall to give access to the cellar H , for the control of the steam-valves $V V$.

The upper chambers, T , O , and U , may be further utilized as dry-rooms, store-rooms, shop, or finishing-rooms, in connection with a planing-mill, sash, blind, and door, or furniture factory, for storing and further seasoning manufactured stock.

Z is the air shaft or chimney, built up from the foundations of the kiln or building, the timbers of which are all substantially framed or spiked together with those of the adjoining portions of the building, in reality being a portion of the building, and yet forming a wide open air-flue from the foundations to the roof, extending transversely the whole width of the kiln, and virtually dividing the kiln into its two distinctive and separate departments—namely, the steaming and the drying departments.

In the base of the chimney the openings r and r' are made for the removal of foul air from the sink R , and for the escape of steam and vapor from the cellar H .

From the base to the line of the ceiling D the chimney is wide enough to admit a load of lumber between the sliding doors l and n when closed down. Above this line, and as high as the roof, the width or space through the chimney is contracted to about two or two

and a half feet, extending across the kiln. At the roof it is beveled or angled, contracted one way and widened the other on the inside, so as to form at the angle z a single square column or shaft about six or eight feet square, which is carried up any distance desired, usually about forty feet, and may be tapered toward the top to about four or five feet square. This form and style of chimney for a dry-kiln, and especially for a lumber-drier, possesses very great advantages. It answers equally well for both the steaming and the drying departments, while it distinctly separates the two, and either may be operated to the exclusion of the other. Being a parallelogram, or nearly such, extending across the kiln from the ground or foundation to the roof, it insures an even and uniform draft clear across the kiln, which is not the case where two or more chimneys are used and the air-currents are divided. The openings $r r'$ at its base insure the removal of the coldest and foulest air of the kiln freighted with moisture and vapor, while the hot and dry air is retained and returned to the heating-chambers.

The space or apartment p serves a very useful and important purpose, allowing, as it does, a load of lumber dripping wet from the steam-bath to stand in the warm or hot draft of the chimney, by which the steam and vapor are removed from the lumber before entering the drying-room.

By contracting the space in the chimney above the line D of the ceiling a stronger draft is insured, and by concentrating the draft in one square or nearly square shaft or stack above the roof, instead of dividing it into two or even three shafts, as may be seen in other kilns, the advantage is at once apparent. Of course one chimney can be erected cheaper than two or three. Being made larger and somewhat tapering toward the top, with its timbers framed or bolted in with the body of the building, it will of course stand firmer and resist the force of wind better.

The air and steam of the kiln, being concentrated into one volume, will be kept warmer in the chimney, and will therefore be discharged at a higher temperature and with greater force and volume than could possibly be done if divided and dispersed by two, three, or more chimneys, as is found in other kilns.

The steam-coils g and g' , concentrated, as they are, at one end of the kiln, in the square or nearly square basement-rooms G and G' , sunk below ground sufficiently to give all necessary and desirable space, can be constructed and set up cheaper than if they were scattered and extended along under the whole length of the building, as done in other kilns. They are in position also to do better and more effectual service. They throw upward a larger and stronger volume of hot air and dry the bottom courses of lumber better, and the greater part of the heated air of the kiln is saved, re-

turned, and reheated. The coils g' force an important and useful circulation in the central and lower portions of the drying-chamber. The air, being received at an elevation, and perflated, as it is, by the blower D through the upper dry chambers to mingle with the hot air from the escape J, finally reaches the coils g in a perfectly dry and warm condition, which is not the case in other steam dry-kilns in general use.

In other kilns the cold air is taken in and introduced at or below ground at a position corresponding with the cellar H, (shown in Figs. 1 and 2,) where the steam of the kiln is usually exhausted, and consequently mingles with the air, and is carried with it back into the kiln, just where it is particularly not wanted.

At the top of the kiln, near the roof, a small tight air-flue may be constructed, if found desirable, connecting the upper chambers, C and U, and another may be made at the bottom of those chambers, just above the ceiling D, and large enough, if desired, to allow the passage of workmen from one chamber to the other, and for the purpose of ventilating the chamber U. The air would naturally pass into this chamber at the top and out at the bottom. These flues or passages can be so made as to form no obstruction to the free working of the vertically-sliding doors l and n , and no material obstruction to the draft of the chimney.

The stationary cast-iron center flanged or ribbed wheels b are arranged, as may be seen in the drawings, in three lines or rows, running longitudinally through the kiln from the entrance E to the exit F, one row through the center and one on either side, near the walls of the kiln.

The lumber may be piled upon the transferring-cars at the saw-mill or at the yard, wherever the assorting and distributing are done, and these cars of lumber may be easily hauled by mules or horses over iron tracks, from any direction whatever, to the turn-table in front of the entrance E, by means of which the car is transferred to the tracks a , which enter the kiln transversely.

The lumber is piled transversely upon the three grooved slides or gliders S' , resting upon the mounted wheels b^1 of the transfer-car C' . The lumber is piled in the usual manner, with outlines in the middle, and at both ends placed directly over the gliders or grooved slides. When the car is brought to position and the mounted wheels b^1 are in range with the fixed wheels b of the kiln, the load of lumber, resting upon the grooved sliders or glides S' , is easily pushed and rolled off from the car, and is thus transferred from the mounted wheels b^1 of the car to the fixed wheels b of the kiln. In this manner the loads of lumber are carried on through the kiln upon these gliders or grooved slides, passing over the fixed wheels b , and at the other end of the kiln the loads of lumber are again rolled upon transfer-cars, and are drawn out at F in the same manner they were entered at E.

By means of the turn-table in front of F any load of lumber not sufficiently dried and seasoned may be returned again to the turn-table in front of E, and may thus be passed through the kiln a second time. By means of this turn-table also, with convenient and suitable tracks therefrom, the loads of dry lumber may be hauled off in any direction and to any distance desired, and may be delivered within a planing-mill, or under sheds for storage, or alongside of railway-cars for shipment.

Ordinarily, by the means of appliances heretofore used, the lumber, in passing through the processes above mentioned from the saw-mill to the shipping-cars, has to be handled, every board piece by piece, twelve times, whereas by the devices and appliances herein set forth the lumber is handled but five times in passing from the mill through the drier, and through the planing-mill to the cars for shipment.

Any one may readily perceive the immense advantage gained and the enormous saving made in handling, drying, and treating lumber in the manner herein indicated. I save in labor seven handlings and two haulings. I save from six months' to one year's time over the ordinary drying and seasoning process.

The atmospheric blower or wind or air receiver L is preferably constructed as follows: Mark out a circle—say twelve feet in diameter—on the roof; then another within this—say five feet in diameter, though they may be made larger or smaller, according to the size of the kiln; then cut out the smaller circle through the roof into the air-chamber M; then set up wings—say, eight or ten feet high—on the four radii of the large circle, dividing it into quadrants; then four others, in the same manner, on the radii bisecting the quadrants into octants; then set eight more, three and one-half feet wide, between the two circles on the radii bisecting the octants. All may be made of lumber and covered with a circular roof resting on and well spiked to the wings. An iron rod, L^1 , is then set up vertically through the center, with a weather-vane, L^2 , attached to the top, and a semicircle of sheet metal or lumber attached to the bottom to form the valve or register f . The vane turns with the wind, closing the leeward half of the circular opening, so that the wind, striking the wings, is deflected to the center and forced down the opening into the receptacle M, and not allowed to escape upward again. From thence the discharge of air into the upper chamber, O, is regulated and controlled automatically by the following means: A funnel-shaped cap or hood, N, is placed on a vertical round post or standard, and rests on a spiral spring, a^2 , surrounding said post. The cap passes loosely over the post, so that it can move up and down on the same.

A cord or wire-rope, b^2 , is attached to the vertex of the cap and passed over pulleys N' , the other end of said cord or wire-rope being fastened to a shutter or register, u , in the

opening through the partition. This shutter or register is to be provided with a spring to hold it open when at rest. A strong blast of wind, pressing down the cap N upon the spiral spring, will pull the rope and partly close the register. The action of the springs will again open the register as the pressure diminishes.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a kiln for drying lumber or any other material, the side entrance, E, and exit F, with doors E' and F', sliding horizontally or vertically, in combination with the transverse tracks *a a*, entering and leaving the same, with turntables in front of each, and in combination with transfer-cars C' and a drying-chamber, C, provided with stationary wheels *b* and grooved slides S', for conveying the lumber or material to be dried through the kiln, substantially as and for the purposes herein set forth.

2. The chimney Z, extending transversely across the kiln from the ground or foundation to the roof, dividing the kiln or building into two separate and distinct departments—a steaming-department and a drying-department—with its upper portion beveled and contracted from the sides toward the center, so as to form one central shaft or stack from the roof upward, provided with the openings *r r'* at its base, for the escape of the foul air, steam, and vapor of the kiln, and provided also with the transverse vertically-sliding doors *l* and *n*, to allow the lumber or other material to be carried through the same to the drying-chambers, substantially as and for the purposes herein set forth.

3. The chimney Z, in combination with the sweating, dripping, and cooling apartment *p*, the exhaust-cellar H, and the steaming-apartment K, substantially as and for the purposes herein set forth.

4. The combination of the chimney Z, apartment *p*, exhaust-cellar H, steaming-apartment K, foul-air sink R, and drying-chamber C, substantially as and for the purposes herein set forth.

5. The foul-air sink R, in combination with the drying-chamber C, steam-coils *g g'*, grated bottom B, opening *r*, sliding doors *l n*, and the chimney Z, substantially as and for the purposes herein set forth.

6. The exhaust-cellar H, in combination with the steaming-apartment K, steam-pipes *e e'*, valves V V, well W, and opening *r'*, and all in combination with the drying-chamber C, grating B, sink R, opening *r*, and chimney Z, substantially as and for the purposes herein set forth.

7. In a kiln for drying lumber or any other material, the atmospheric blower or wind-receiver L, with its automatic regulator N N', for the perflation of air into and through the kiln, substantially as and for the purposes herein set forth.

8. The heating-apartment G, with its steam-

coils *g*, it being a basement-room sunk in the ground at one end of the kiln, in combination with the air-passage P and inlet *i*, drying-chamber C, inclined grated bottom B, sink R, opening or escape *r*, and chimney Z, all constructed and arranged substantially as and for the purposes herein set forth.

9. The reheating-apartment G', with its steam-coils *g'*, in combination with the returning-air sink Q and inlet C, the grating B, and drying-chamber O, substantially as and for the purposes herein set forth.

10. The sweating or dripping chamber *p*, in combination with the drying-chamber C, steaming-apartment K, and chimney Z, substantially as and for the purposes herein set forth.

11. The upper air and drying chambers or store-rooms, M T O U, having transverse vertically-sliding doors *l n m*, rising into the same by means of the wire ropes *x*, pulleys and weight *w'*, in combination with the hot-air escape J and drying-chamber C, substantially as and for the purposes herein set forth.

12. The fixed or stationary wheels *b b* and grooved slides or gliders S', for carrying the lumber or other materials through the kiln, in combination with the transverse tracks *a a* and the transferring-cars C', substantially as and for the purposes herein set forth.

13. In a kiln for drying lumber or any other materials, the fixed wheels *b b*, flanged, ribbed, or grooved, with the corresponding and accompanying slides or gliders S', flanged, ribbed, or grooved to match and fit the wheels arranged for carrying the materials to be dried through the kiln, and either with or without transferring-cars and transverse tracks, substantially as and for the purposes herein set forth.

14. The transferring-cars C', with their mounted wheels *b¹* and accompanying or corresponding gliders S', in combination with the transverse tracks *a* and the stationary wheels *b*, arranged and used in a dry-kiln, substantially as and for the purposes herein set forth.

15. In a dry-kiln for any purpose, the open inclined bottom or grating B, extending through the kiln from E to F, in combination with and dividing the basement-rooms G G', Q R and H from the drying and steaming chambers C and K above the same, and all in combination with the exhaust-chimney Z, constructed and arranged substantially as and for the purposes herein set forth.

16. The well W, in combination with the drain and drip pipes *e, e'*, and *d*, the chimney Z, chambers K and *p*, and cellar H, located and arranged substantially as and for the purposes herein set forth.

17. In a lumber-drier, the transverse tracks *a a* and the longitudinal tracks outside, with the turntables in front of and in combination with the side entrance, E, and exit F, with sliding doors E' and F', and all in combination with transfer-cars C', with mounted wheels *b¹*,

and the drying-chamber C, provided with the fixed wheels *b*, for carrying through the lumber, substantially as and for the purposes herein set forth.

18. The combination of the atmospheric blower or air-receiver L with valve *f*, the sliding cap N, spring *a*², rope *b*², and register *u*, substantially as and for the purposes herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 28th day of December, 1878.

CARLOS WILCOX.

Witnesses:

FRANK B. CORNELL,

H. L. BIRGE.