(No Model.)

2 Sheets—Sheet 1.

# D. W. ANDERSON.

## DRYING APPARATUS.

No. 511,184. Patented Dec. 19, 1893.

Fig. 1

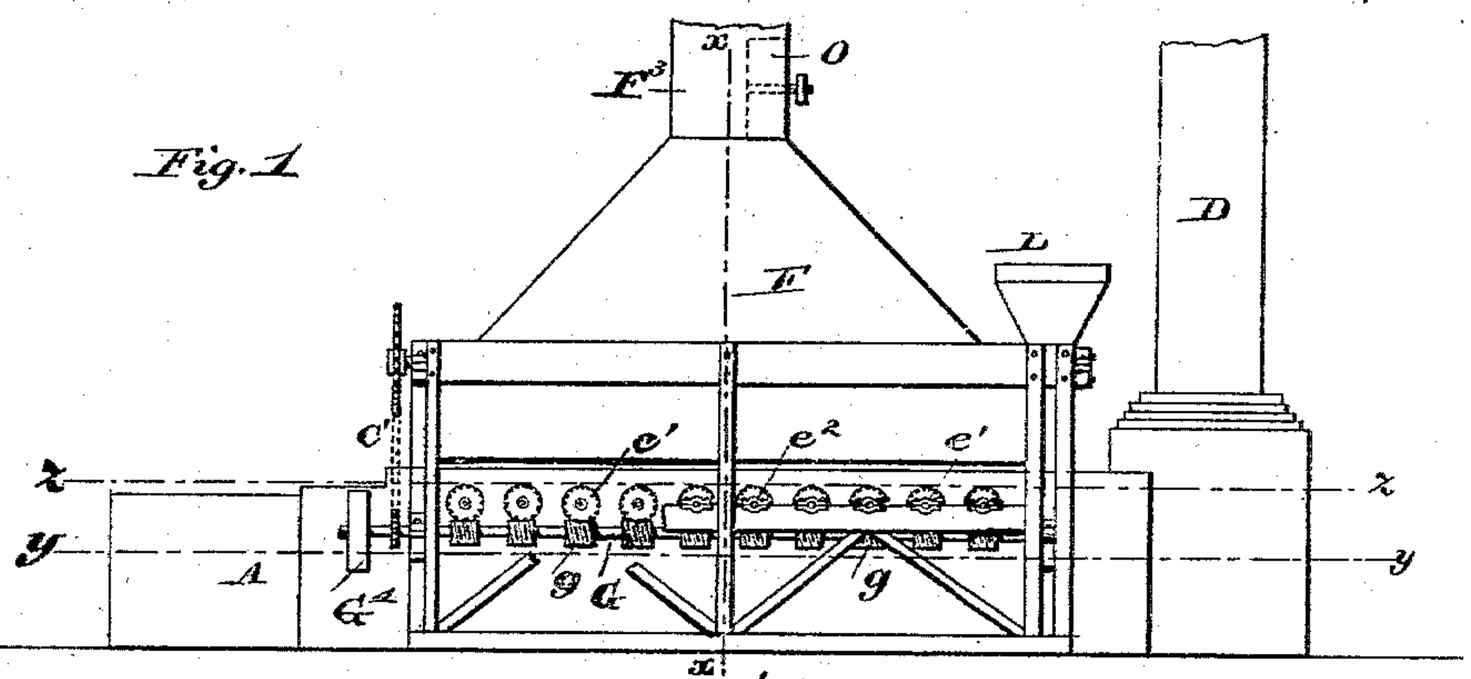



Fig. 2

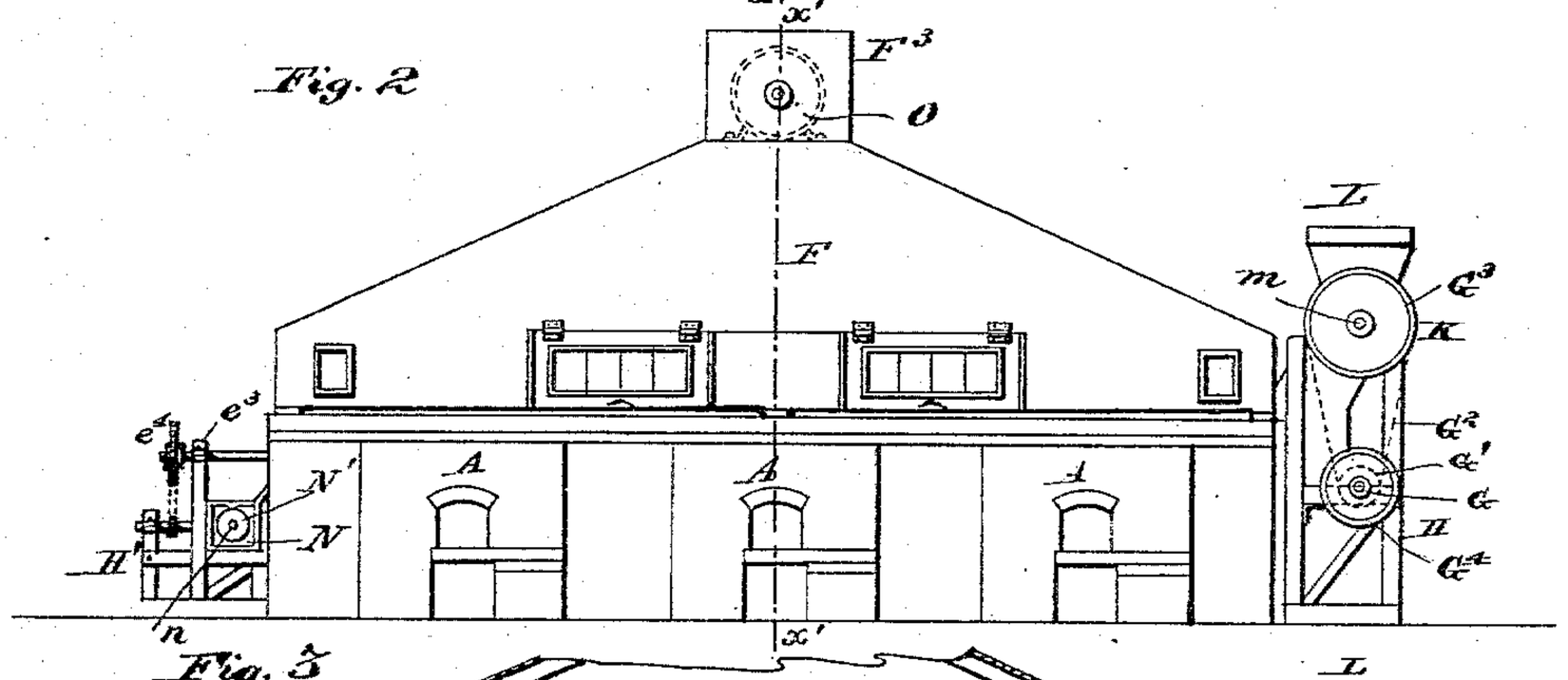



Fig. 3

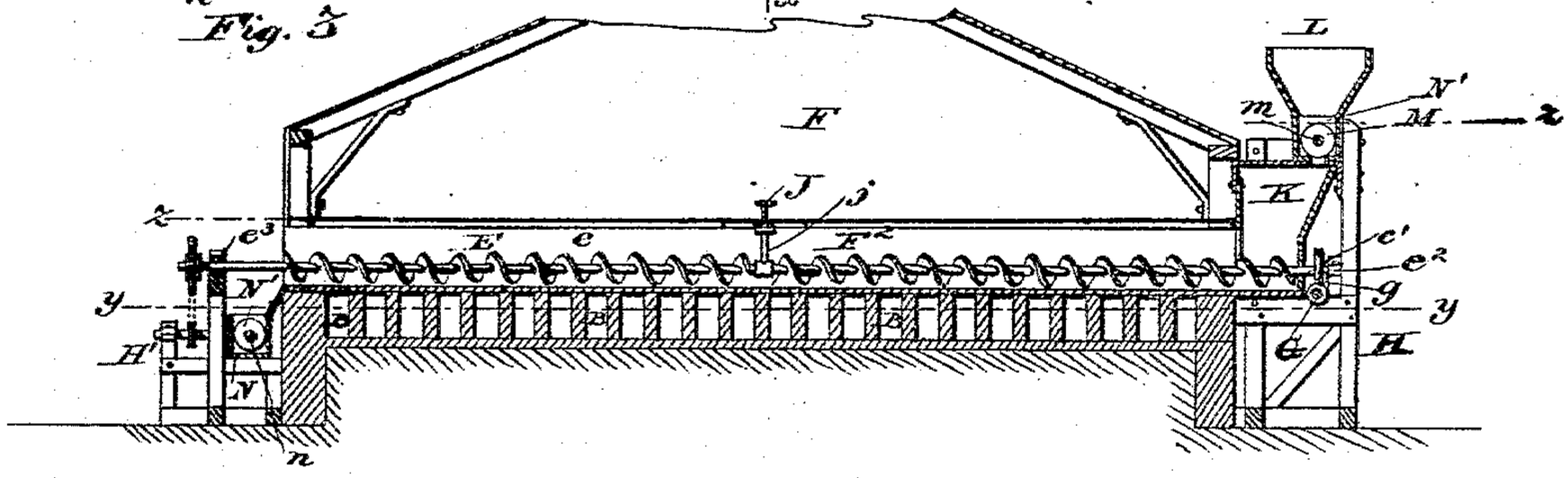
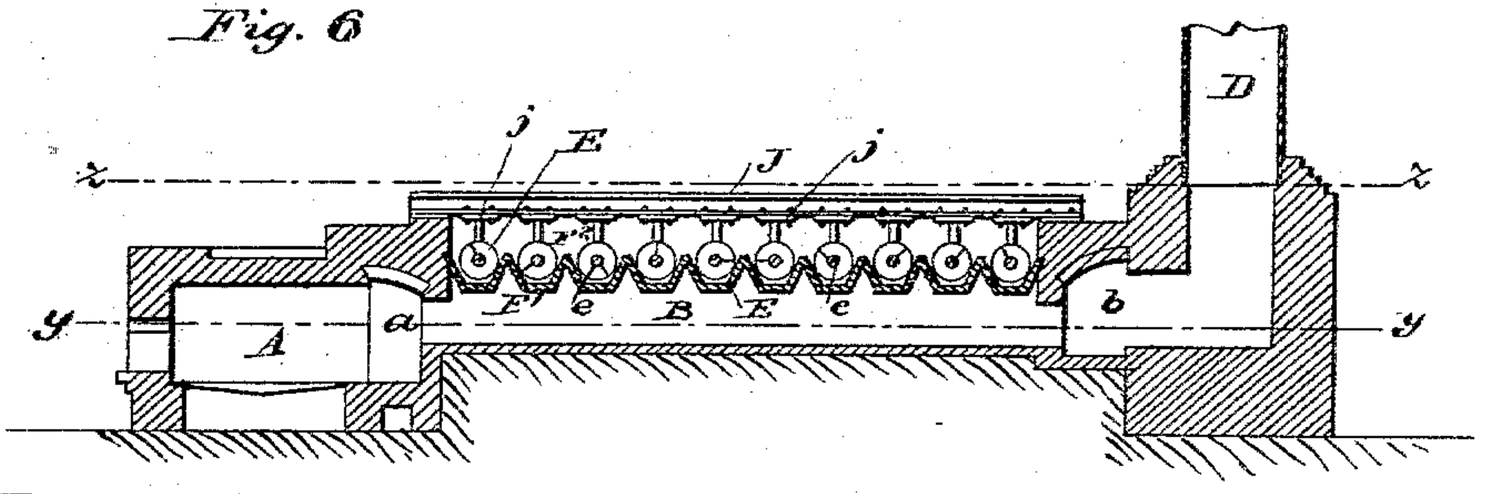



Fig. 6




Witnesses:

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Inventor

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by Dickerson & Brown

Att'ys.

THE NATIONAL LITHOGRAPHING COMPANY,
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(No Model.) 2 Sheets—Sheet 2.

# D. W. ANDERSON.

## DRYING APPARATUS.

No. 511,184. Patented Dec. 19, 1893.

Fig. 4

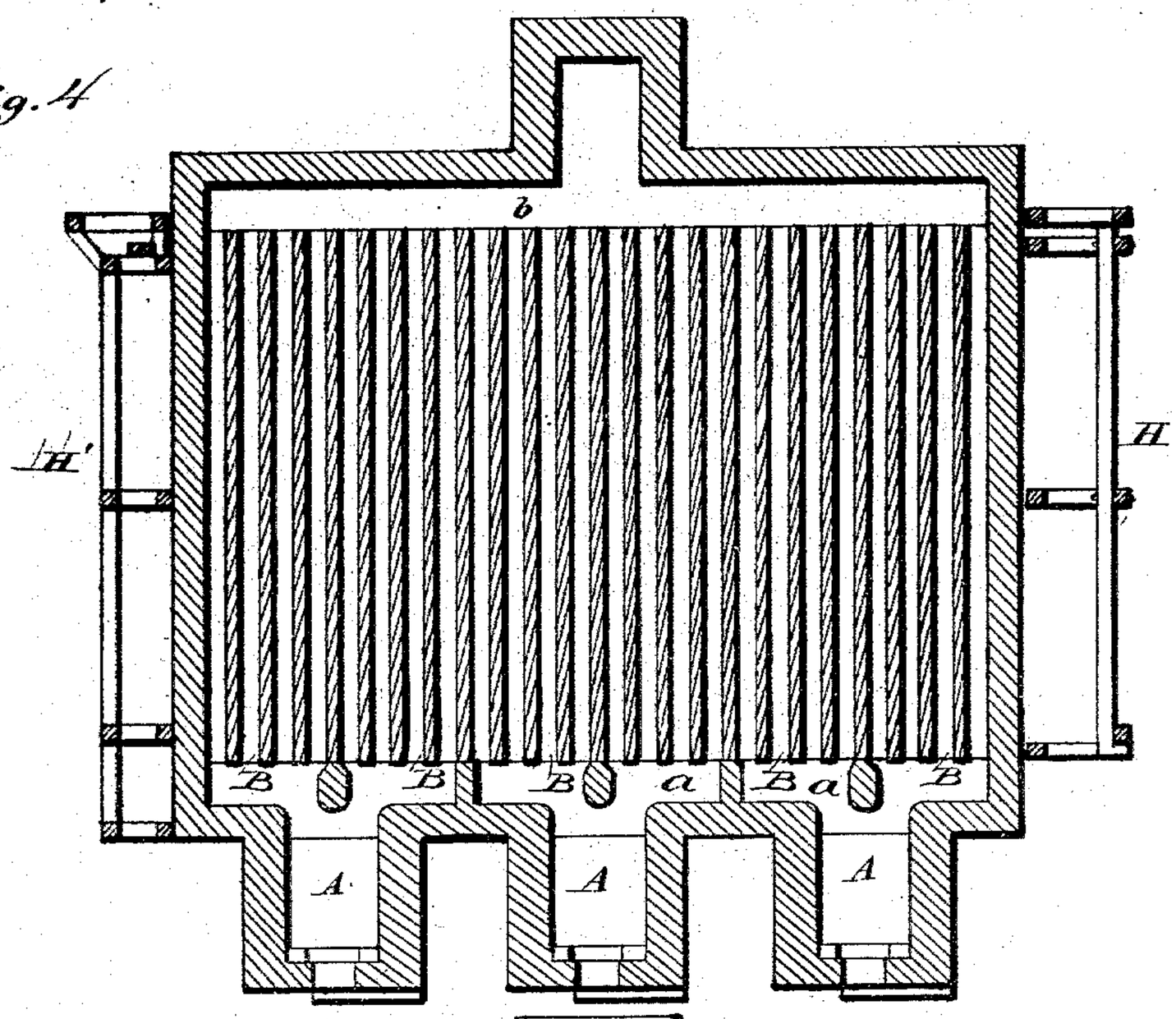
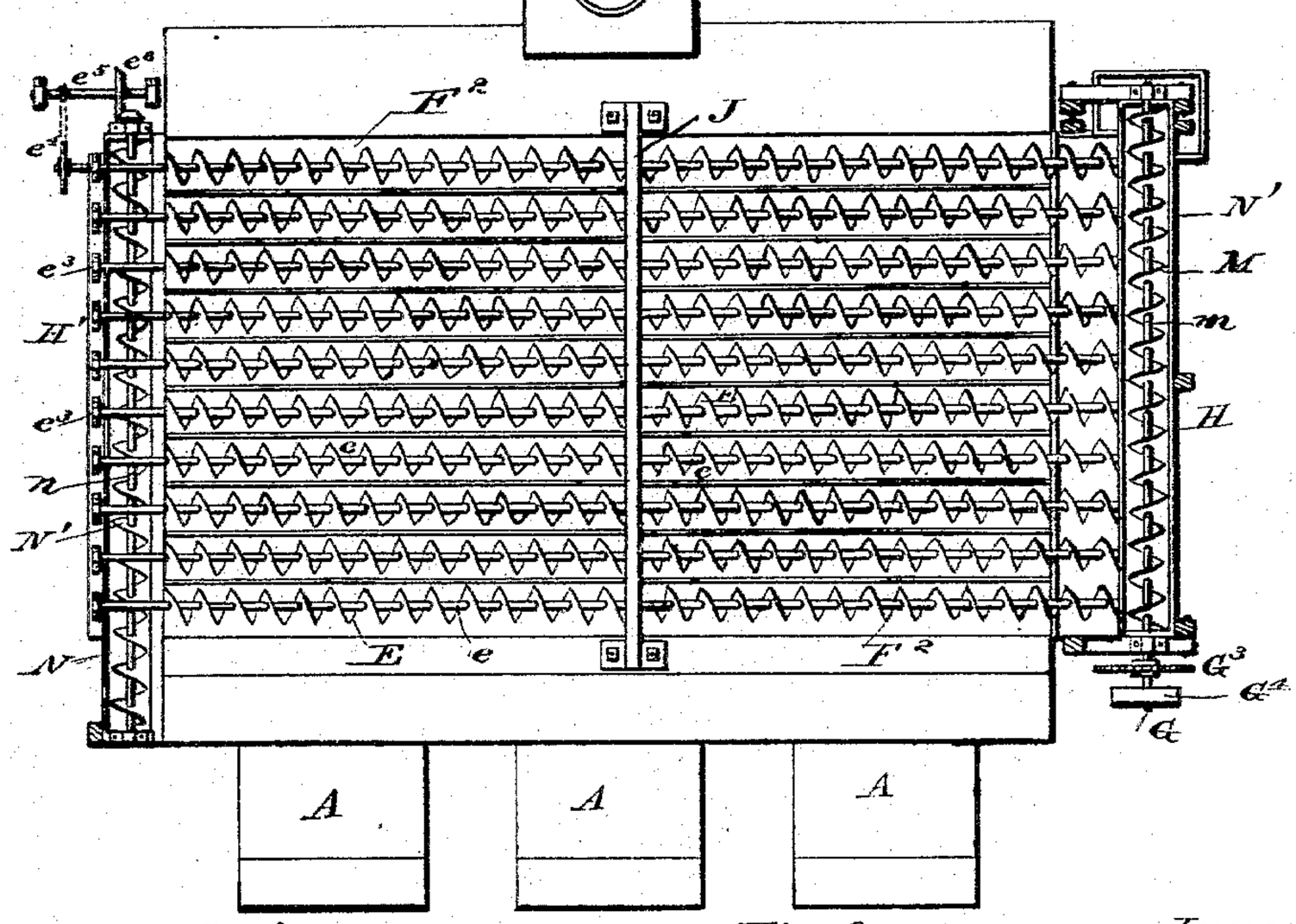



Fig. 5




Witnesses:

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M. B. Mackey

Fig. 7

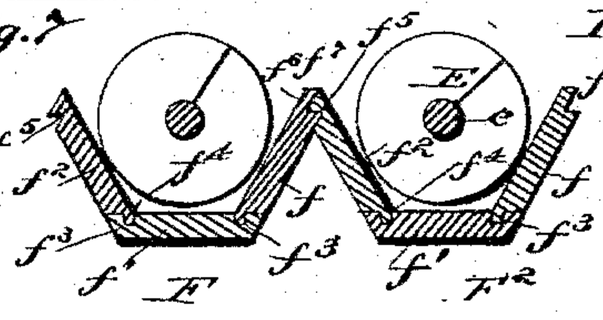
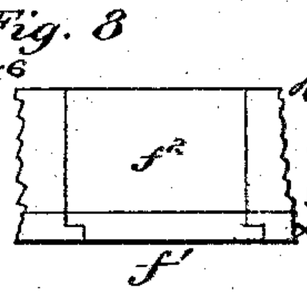



Fig. 8




Inventor

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by Church & Church

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THE NATIONAL LITHOGRAPHING COMPANY,
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# UNITED STATES PATENT OFFICE.

DAVID WILEY ANDERSON, OF RICHMOND, VIRGINIA.

## DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 511,184, dated December 19, 1893.

Application filed March 12, 1892. Serial No. 424,662. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID WILEY ANDERSON, a citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Drying Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in mechanisms for drying, it pertaining more especially to mechanisms of the sort intended for treating materials that will sustain a very high heat without destruction of their valuable qualities, and to which the material is fed rapidly in large quantities.

Figure 1 is a side elevation of a mechanism embodying my improvement. Fig. 2 is an end view of the same. Fig. 3 is a vertical cross section on the line *x*—*x*, Fig. 1. Fig. 4 is a horizontal section on the line *y*—*y*, Fig. 1. Fig. 5 is a horizontal section on the line *z*—*z*, Figs. 1 and 3. Fig. 6 is a vertical cross section on the line *x'*, *x'*, Fig. 2. Figs. 7 and 8 show details.

In the drawings A A indicate fire chambers, of which any suitable number may be used, and each of which may, so far as concerns the details of construction, be of any suitable character. The products of combustion pass from each fire chamber through a throat or passage way *a* and thence through comparatively long, narrow flues B B, there being preferably several of the latter communicating with each throat *a*. They extend across and under the drying chamber proper, and at their opposite ends communicate with a collecting flue or passage *b*, which in turn communicates with the stack D that withdraws the product of combustion from all of the furnaces and flues B. The top or upper walls of these flues B B constitute also the bottom wall or floor of the drying chamber. This bottom is constructed of a series of conveyer troughs $F^2$ which are tightly joined together so as to form a substantially continuous floor of a corrugated form in section. It is as a whole indicated by the letter F' and the preferred details of construction will be herein below fully set forth.

In each of the troughs $F^2$ provided as aforesaid there is arranged a conveyer E mounted upon a shaft *e*. Of these conveyers there may be any suitable number. They are placed parallel to each other and are mounted on lines transverse to flues B, so that the products of combustion are compelled to pass across and below the whole series of conveyer troughs. The shafts *e e* are mounted in bearings $e^2$, $e^3$ supported upon frames H and H' at the sides of the apparatus. In the side wall of the drying chamber proper, there are apertures or openings, there being two of these opposite to each other for each conveyer E. The conveyers extend preferably somewhat beyond the side wall at the side where the feeding of the material is effected and to or somewhat through that wall at which the delivery is caused.

At *e'* each conveyer shaft *e* is provided with a worm wheel, the worm wheels on the several conveyer shafts being in line with each other, and all simultaneously actuated by means of a worm shaft G provided with a series of worms *g* respectively corresponding to the said wheels *e'*.

At the feed end of the conveyers there is a supply chamber K, or a series of chambers communicating with the conveyer troughs. Above the feeding chamber or chambers there is an initial feeding hopper L. This, at the bottom communicates with a conveyer trunk or trough N' containing the conveyer M mounted upon the shaft *m*. This shaft receives power from the shaft G through the chain gearing at G', $G^2$, $G^3$, the power being imparted to the whole mechanism through the belt wheel at $G^4$.

The conveyers deliver the material into a trunk or trough at N supported on the framing at H', there being in this trough a conveyer N' mounted upon a shaft *n*. Power is conveyed to shaft *n* from one of the conveyer shafts *e* through the chain gearing at $e^4$, the shaft $e^5$, and the bevel gearing at $e^6$, the gearing being so speeded that the collecting and withdrawing conveyer N shall rotate much more rapidly than those at E.

Above the conveyers E E the walls of the drying apartment F are so constructed that the said apartment shall taper or narrow upwardly, it communicating with a flue at $F^3$ wherein an exhaust fan O of sufficient capacity is placed.

The preferred material for and manner of constructing and arranging the parts along which the material to be dried is conveyed are as follows. The floor F′ of the drying apartment, as above said is of a zig-zag or corrugated shape in cross section the depth and other dimensions of each of the depressions being such that it is adapted to serve as a trough, as at $F^2$ for a conveyer E. As shown each of these depressions or troughs is formed of a bottom $f'$ $f$ and two side parts $f$ $f^2$. These are all formed of tiling, fire clay, terra cotta, or other similar and suitably refractory material, capable of sustaining an exceedingly high heat without rapid destruction. The series of troughs is built up of sections of the selected refractory material, each section being shaped in the way shown in Figs. 7 and 8. The bottom part $f'$ of each trough has grooves $f^3$, and the side walls $f$ $f^2$ have tongues at $f^4$ adapted to fit in said grooves, and to thus provide a joint sufficiently firm to secure the parts together, and sufficiently tight to prevent the escape of material at the lines of junction. At the upper ends or edges the sections are so shaped as to interlock and fit snugly, as shown in Fig. 7. The side piece $f$ is rabbeted at $f^6$, and the side piece $f^2$ of an adjacent trough is grooved at $f^5$ to receive the shoulder part of the adjacent section at $f^7$.

As is well known the pipes, metal surfaces, and other supports for the material which have been used in drying mechanisms have been the principle source of loss and trouble, owing to the fact that they so rapidly burn out when subjected to the exceedingly high heat which it is desired to apply when treating many sorts of material. The supporting floor, or conveyer troughs herein provided are free from this trouble as it is practically impossible to destroy them by the heat generated in the fire chamber.

From an examination of the drawings, it will be seen that peculiar features of construction are incident to the parts above described and which enable me to cheaply construct a large and durable drier capable of receiving an exceedingly high heat and imparting the same to what is practically an extensive sheet of material. If one of the dimensions and capacity of this shown were constructed upon any of the numerous earlier plans known to me, it would be so expensive as to prohibit its introduction into use for treating common materials like sand, clay, marl, phosphates, &c., which must be handled by cheap mechanisms in large quantities. It will be seen that the vertical walls B of the fire flues, not only act to distribute the products of combustion uniformly over the whole of the extensive drying floor, but moreover, that they act as the holders for the flat earthen-ware or tile plates which are laid directly upon them so that no metal whatever, is required at places where it can be impinged upon by the highly heated currents. By disposing the parts so that I can use flat tiles and support them on the flue walls, and so shaping them that I can form a flame-tight flooring or series of conveyer chambers, I can obtain at a very low price all the necessary materials for this part of the apparatus. These flat tiles are so arranged as to present only a relatively thin partition between the flame chamber and the material, the products of combustion being able to impart heat in the angular spaces between the conveyers to the upper part of the mass of material as well as to the bottom portion that rests on the flat sections $f'$.

I am aware that ores have been roasted by moving them from one spiral conveyer to another, successively in lower horizontal planes, over a fire flue having a metallic ceiling which supports ordinary brick in solid masses between the conveyers, as is shown in Patent No. 464,103 to O'Brien dated December 1, 1893, and I do not claim such a construction as of my invention.

I am also aware that grain has been passed through a series of horizontally arranged conveyer chambers formed of metal with numerous perforations adapted to permit the products of combustion to pass through, as shown in Patent No. 40,130 to Sutton and Gibson dated September 29, 1863; and I do not claim any of the features of such a mechanism as of my invention.

I also know that it has been proposed to roast ores by passing them through conveyer chambers, successively in a vertical series, each formed with a metallic lining, and in which the fire was formed directly in the conveyer chamber in contact with the material as shown in Patent No. 365,393, to Lord, and such constructions also I disclaim.

I may also say that I do not claim broadly the use of refractory materials as I am aware that they have been used for a long period in stoves, furnaces, glass pots, coffee roasters, &c.

In order to support the comparatively elongated conveyer shafts $e$, I combine with them a central support J, adapted to carry a series of bearings, which are held by brackets $j$, extending down from the cross support J. The conveyers may each be made in two or more sections, the adjacent ends of the sections being supported by means of such devices as those just described, at J, $j$, or each conveyer shaft may be continued from the bearing $e'$ to the bearing $e^2$.

The manner of operating the mechanism above described, and shown in the drawings will be readily understood. The material is fed as uniformly as possible to the hopper L, and from this it is carried along the trough N′ by the conveyer N which distributes it in substantially equal quantities to the several conveyers of the whole series. By the latter it is advanced at the desired speed along the troughs F′. The fires in the furnaces at A A, being lighted, the heated products of combustion passing through the flues B, heat the troughs F′ constituting the floor F, to a high

degree, and as the material (such as phosphate, marl, clay, &c.) is advanced along the same in a suitably thin sheet or layer, the moisture therein is heated correspondingly high and is driven out rapidly therefrom. As it rises into the tapering upper part of the drying chamber, it is rapidly withdrawn therefrom by means of the fan at O. By examining the drawings it will be seen that the feed or supply conveyer also moves at a speed relatively greater than that of the advancing conveyers E, worm gearing, as at G, $e'$, being preferably used, and acting, as will be readily understood, to reduce the speed at which the advancing conveyers E rotate, so that a single conveying device situated outside of the end wall of the drying apartment can be used to supply all of the advancing conveyers; and as above described a single withdrawing conveyer as at N′ can be used for carrying away the material from the whole series of conveyers E. It will also be seen that the flues for the products of combustion are situated transversely to the path of the material that moves through the dry room, and as a result the heat can be more uniformly and equably distributed under the whole mass. These flues are relatively reduced in cross section, in comparison with the cross section of the fire chambers, the walls between the flues being constructed of tiling, clay, or suitable refractory earth material. This enables me to retain in proximity to the material to be treated a large amount of the heat and prevent its too rapid escape to the stack or chimney; and also enables me to readily provide a support for the sections of tiling which form the conveyer trough in the drying apartment. These sections of tiling, to be readily manufactured cheaply, must be made comparatively small, and therefore frequent supports are required for them, and such supports are at hand when the flues are constructed in the way shown and described.

Of course, it will be understood that there can be modifications made in several respects, without departing from the spirit of the invention. The fire tile trough or conveyer compartment in the drying room may be of various shapes and dimensions without materially altering the essential features of the structure. Nor do I wish to limit all of the features of the invention to the fact shown, namely, that the advancing conveyers are arranged transversely to the paths of the products of combustion.

What I claim is—

1. In an apparatus for drying clay, sand and similar materials, the combination of the fire chamber, the smoke exhaust chamber, the fire flues having vertical walls, and communicating with said chambers, the flat earthen-ware plates or tiles $f'$ resting on said flue walls, the flat plates or tile sections $f$, $f^2$ joined flame-tight at their upper edges and to the plates or sections $f'$ at their lower edges, whereby a drying chamber above them is formed and a heating chamber below them extending around the three flat sides, and a spiral conveyer adjacent to the walls formed of the said plates or tiles, substantially as set forth.

2. In an apparatus for drying clay, sand, and similar materials, the combination of the fire chambers upon one side, the smoke exhaust chamber on the opposite side, the series of walls B′ extending from the fire chamber to the smoke chamber and forming a relatively large number of reduced fire flues and also supporting the heating walls, the flat earthenware plates or tiles $f'$ resting on the tops of said flue walls B′ and arranged transversely thereto, the flat oppositely inclined earthenware plates $f$, $f^2$, each secured by tongue and groove to the said bottom plates $f'$, and at their upper edges secured to correspondingly inclined plates by tongue and groove connections, whereby a series of passage ways is formed with flat walls constituting a tight continuous bottom for the drying department, a series of parallel conveyers E mounted respectively in the said compartments, and a transverse distributing conveyer supplying material to all of the aforesaid conveyers simultaneously, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

DAVID WILEY ANDERSON.

Witnesses:

WILLIAM J. WOODS,

ARTHELO R. ROOT.