

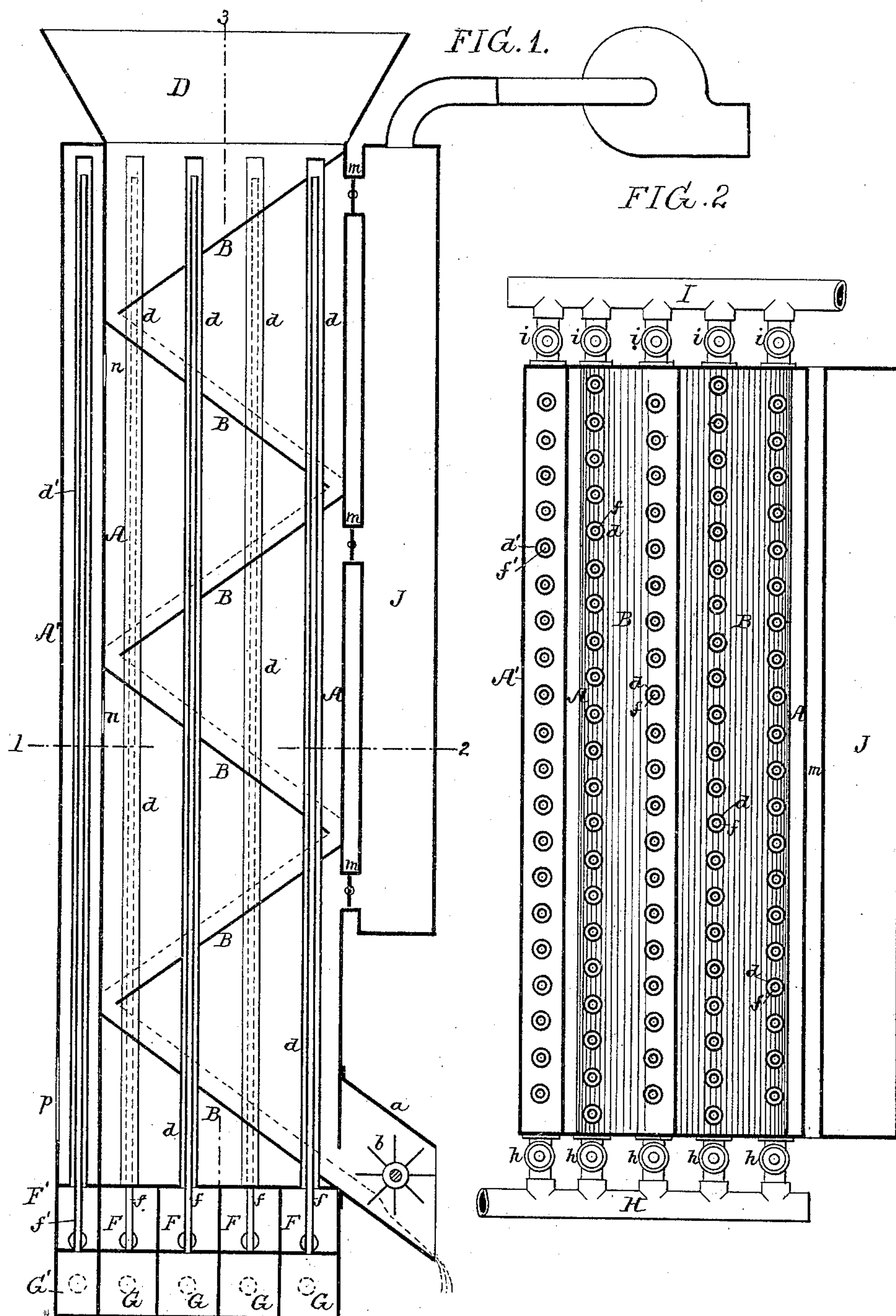
(No Model.)

2 Sheets—Sheet 1.

G. H. IMMENDORF.
GRAIN DRIER.

No. 409,287.

Patented Aug. 20, 1889.



Witnesses
William D. Bonner
John E. Parker.

Inventor:
G. H. Immendorf
by his Attorneys
Howson & Son

(No Model.)

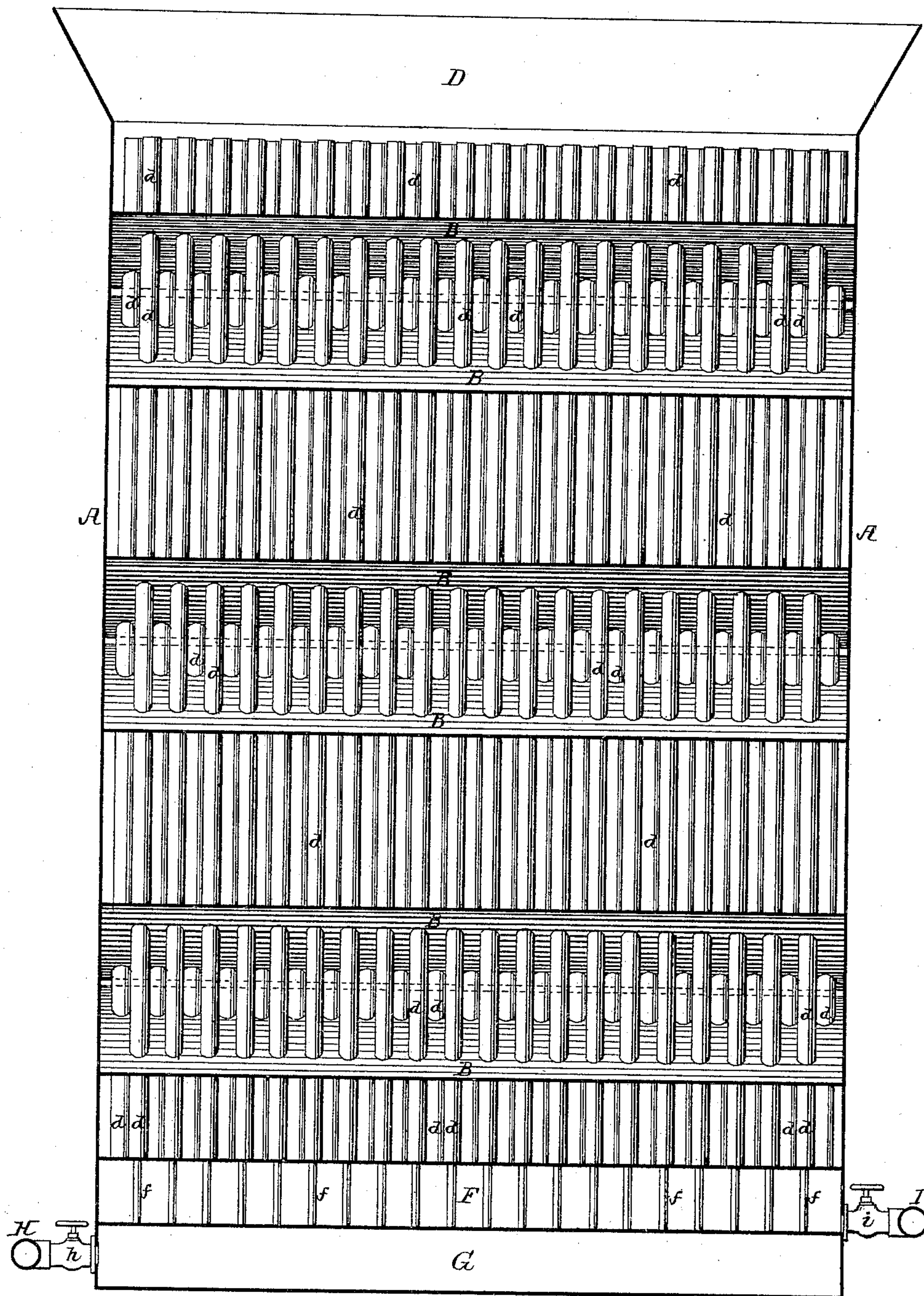
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FIG. 3.



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UNITED STATES PATENT OFFICE.

GEORGE H. IMMENDORF, OF PHILADELPHIA, PENNSYLVANIA.

GRAIN-DRIER.

SPECIFICATION forming part of Letters Patent No. 409,287, dated August 20, 1889.

Application filed June 4, 1887. Serial No. 240,273. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. IMMENDORF, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Grain-Driers, of which the following is a specification.

The object of my invention is to so construct a grain-drier as to insure the thorough heating of all portions of the mass of grain passing through the drier and the free escape of all the vapors driven from the grain by the heat. This object I attain in the manner which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1 is a transverse section of a grain-drier constructed in accordance with my invention. Fig. 2 is a sectional plan view of the same on the line 1 2, and Fig. 3 a longitudinal section on the line 3 4.

The main casing A of the heater is in the present instance quadrangular and has arranged one above another a series of internal longitudinal shelves B, extending from end to end of the casing and inclined in opposite directions, the first shelf extending from one side of the casing nearly to the opposite side, the second shelf from the latter side back toward the first side, and so on, whereby the grain introduced into the drier through the hopper D at the top of the casing passes down the shelves in succession, and is finally discharged through a spout *a* at one side of the structure, this spout being provided with a slowly-revolving vaned wheel *b* or other suitable regulator, by which the speed of the discharge can be readily governed.

In the lower portion of the casing A are a series of chambers F and G, and with the chambers F communicate a number of parallel longitudinal rows or sets of vertical tubes *d*, which extend to or almost to the top of the casing and are closed at their upper ends. Within each tube *d* is a smaller tube *f*, open at the top and terminating some distance below the top of the tube *d*, said internal tubes *f* communicating at their lower ends with the chambers G. Steam is admitted to these chambers G through suitable valved branches *h*, communicating with a main supply-pipe H, the steam ascending the small internal tubes *f* and descending between the same and the

outer tubes *d* to the chambers F, from which the water of condensation is drained by means of valved branches *i*, communicating with a main discharge-pipe I.

There are in the present instance four parallel longitudinal rows or sets of tubes *d*, those of the first and third rows being in line with the spaces between the tubes of the second and fourth rows, and the diameter of each tube is equal to or slightly in excess of the width of the spaces between the tubes of the adjacent rows. As the grain flows down each shelf, therefore, it must necessarily be brought into direct contact with the tubes *d* of two or more of the longitudinal rows of tubes, and as these tubes are heated by reason of the circulation of the steam through the same the grain must be thoroughly heated by this direct contact with said tubes, so that the moisture contained in the grain will be driven therefrom.

To provide for the effective removal of the moisture from the apparatus, a circulation of air is preferably maintained through each chamber of the apparatus and through or over the descending streams of grain; hence I provide at one side of the casing A an exhaust-duct J, which communicates through a suitable valved branch *m* with each chamber on that side of the casing, preferably at a point beneath the top of one of the shelves B. When a partial vacuum is created in this duct by means of a suction-fan or other suitable apparatus, air is caused to enter the casing through openings *n* in the opposite side of the same and through the discharge-spout, and this air is drawn through or over the streams of grain descending the shelves B, so as to effectually carry off any moisture that may be driven from said grain by reason of the heat to which it is subjected.

If desired, the air may be heated before being allowed to enter the casing A, the latter in this case being provided at one side with a supplementary casing A', inclosing a chamber containing heating-tubes *d'*, which communicate with a discharge-chamber F' and are supplied with steam through internal tubes *f'*, communicating with a steam-chamber G', so that said tubes *d'* serve to properly heat the volumes of air entering the casing A' at the bottom through an opening *p*.

The grain lies upon the shelves B, as indicated by dotted lines, each shelf, except the lowest, extending to within a short distance of the shelf beneath, the layers of grain assuming the angle of rest and the depth of the layer on each shelf being determined by the proximity of the discharge end of the shelf above; hence a limited quantity of grain flows onto each shelf as a like quantity of grain is permitted to escape from the lowest shelf by the vaned wheel *b*. The grain is thus maintained in layers of limited depth, so that the free escape of the vapors therefrom is permitted, while the speed of descent can be regulated as desired and the grain subjected to the heating action of the tubes *d* for as long a period as the condition of the grain may require.

As each longitudinal row or set of tubes is supplied with steam independently of the others, as few or as many rows may be used as circumstances suggest, and in case of a defect in any of the tubes steam need be cut off only from the row containing the defective tube, the other rows of tubes supplying heat and permitting the apparatus to remain in use until a convenient opportunity is afforded for effecting the necessary repairs.

Hot air instead of steam may be employed for heating the tubes *d*, and the internal tubes *f* may, if desired, be dispensed with, although their use is preferred.

I claim as my invention—

The combination of the casing having a series of shelves inclined alternately in opposite directions, and each, except the discharge-shelf, terminating within a short distance of the shelf below, with a discharge-regulator at the bottom shelf, and a series of longitudinal rows of heated and imperforate tubes passing upward through each of the inclined shelves of the casing, the tubes of one row being in line with the spaces between the tubes of the adjoining rows and being of a diameter substantially equal to the width of said spaces, all substantially as specified.

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

GEORGE H. IMMENDORF.

Witnesses:

WILLIAM D. CONNER,
HARRY SMITH.