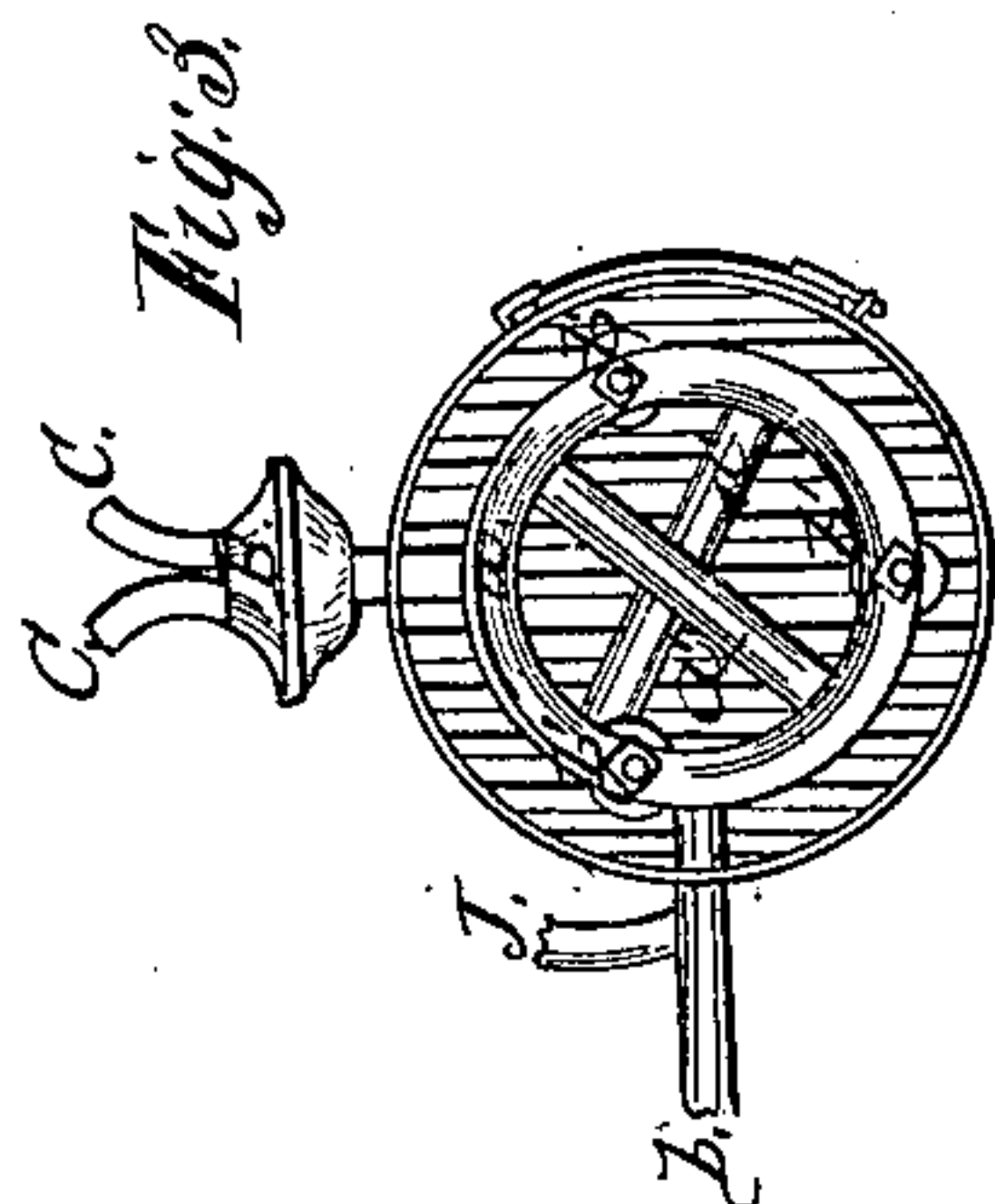
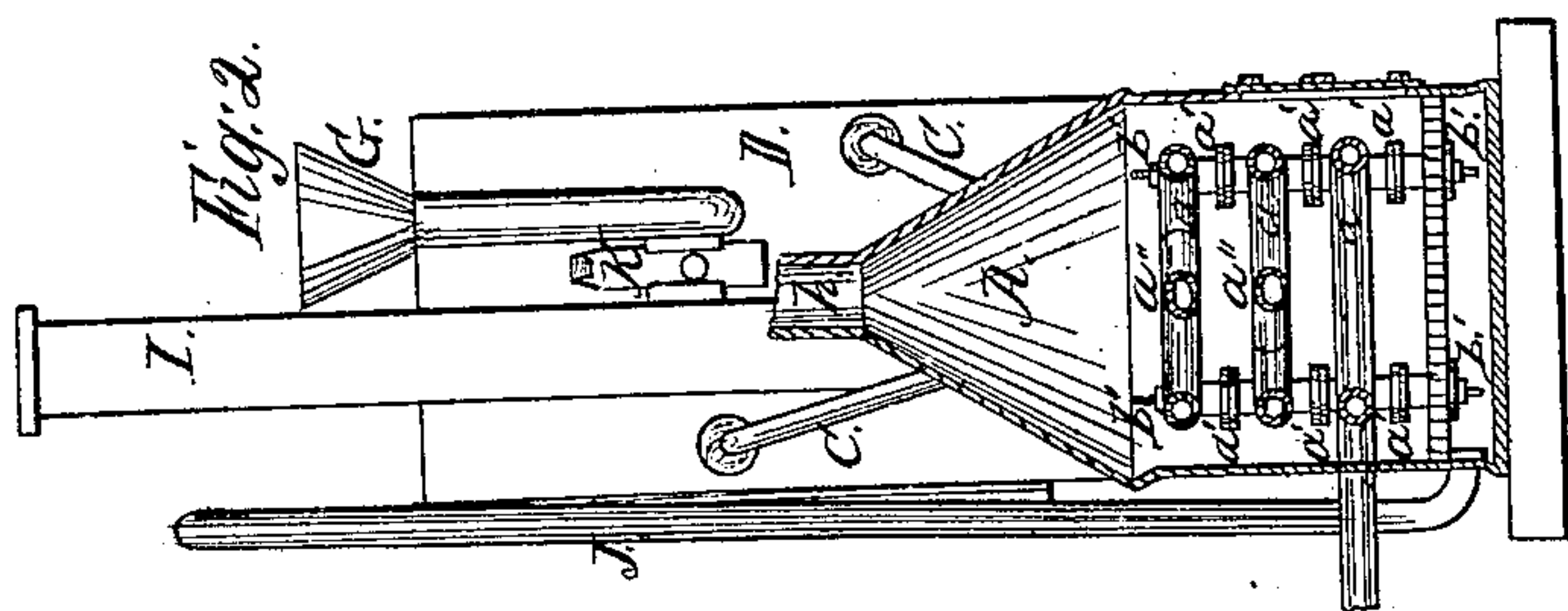
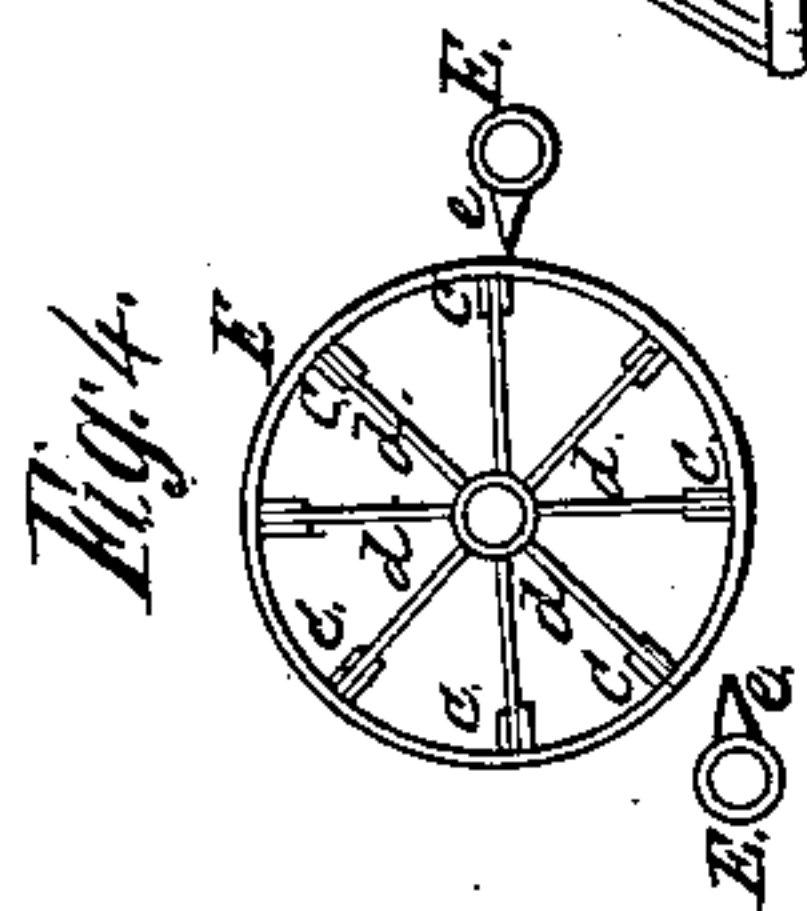
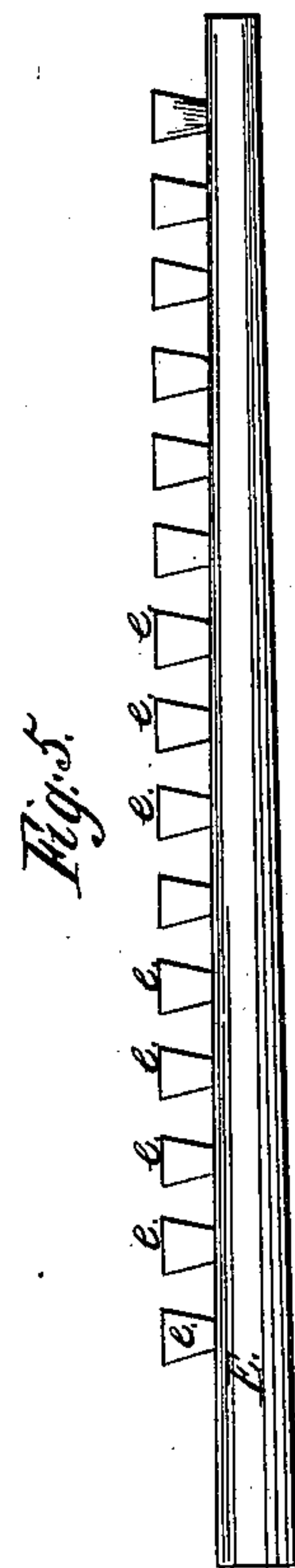
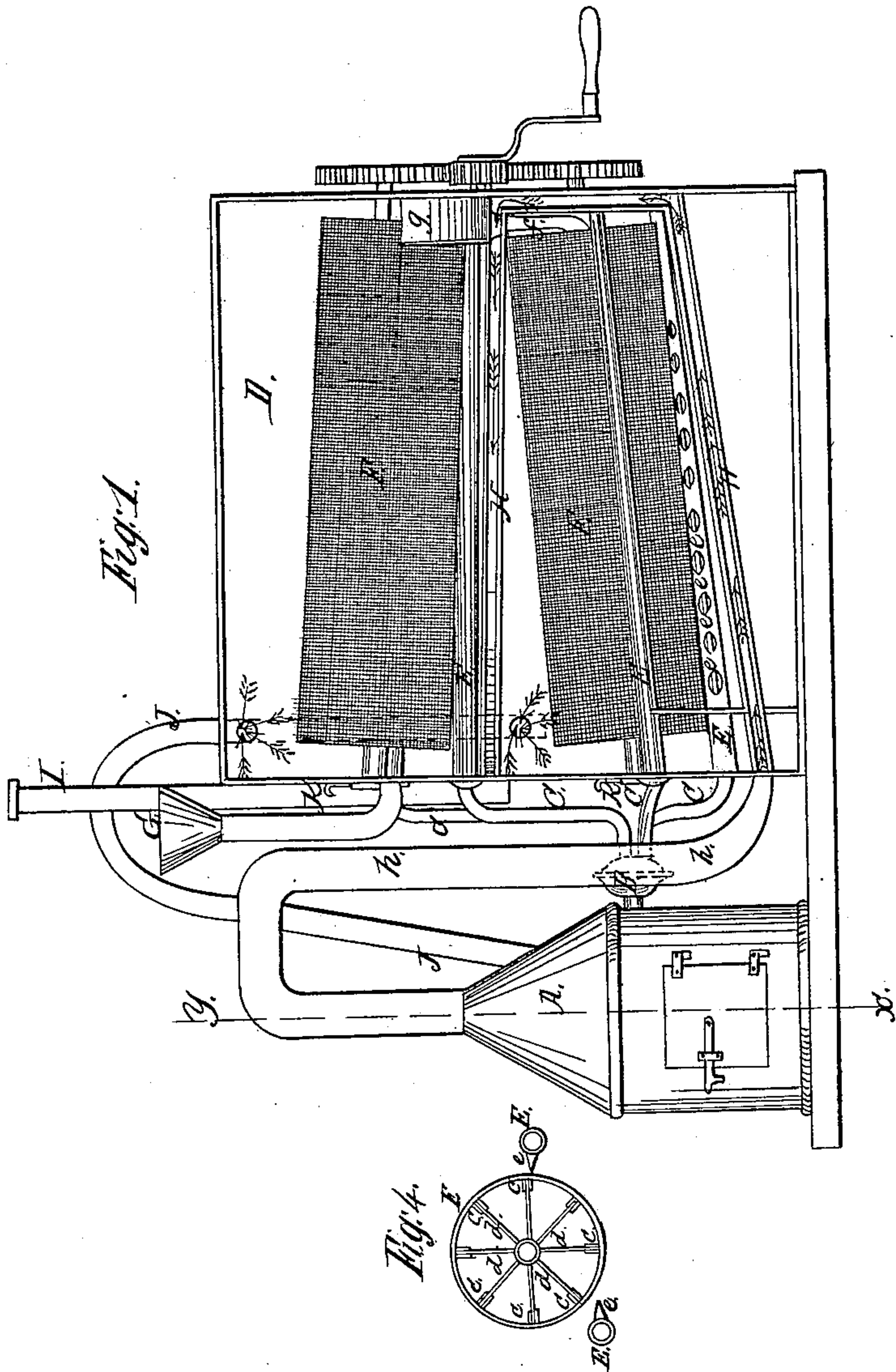


A. T. BOON & C. L. STEVENS.
GRAIN DRIER.

No. 50,792.

Patented Nov. 7, 1865.



Witnesses.

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UNITED STATES PATENT OFFICE.

ALONZO T. BOON AND CHAS. L. STEVENS, OF GALESBURG, ILLINOIS.

GRAIN-DRIER.

Specification forming part of Letters Patent No. 50,792, dated November 7, 1865.

To all whom it may concern:

Be it known that we, ALONZO T. BOON and CHAS. L. STEVENS, of the city of Galesburg, in the county of Knox and State of Illinois, have invented a new and useful Improvement in Grain-Driers; and we do hereby declare the following to be a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a front or side view of our apparatus for kiln-drying all kinds of grain or other substances; Fig. 2, an end view of oven and vertical section of furnace, as indicated by line *xy* in Fig. 1; Fig. 3, top view of furnace, showing upper convex portion of it removed in order to give an interior view of same; Fig. 4, end view of the grain-cylinders and like view of longitudinal tubes having jets or nozzles bearing upon it; Fig. 5, full-length view of tube, showing clearly the jets or nozzles.

Like letters in all figures of the drawings indicate like parts.

The nature of our invention consists of an apparatus for kiln-drying all kinds of grain and other substances by means of atmospheric air heated in a series of ring-tubes placed within a furnace, and the application of it thereafter to the outer surfaces of grain-cylinders through longitudinal tubes having a series of nozzles or jets, from which the hot air is ejected onto the grain in the cylinders through the wire covering or perforated sheet-iron that may inclose the cylinders.

In all or most of the apparatuses now in use the hot air is applied on the inside of the cylinders, the effect of which is to give a direct blast to the grain, and thereby, to a more or less extent, scorch or otherwise injure it. To remedy this we apply the hot air to the outer surfaces of the cylinders, as above stated, the interposition of the wire covering or perforated sheet-iron surfaces between the nozzles and the grain breaking the force of the hot air, so that it reaches the grain indirectly, and thus modifies the effect of the heat from the hot air.

Our invention also consists in using the products of combustion from the furnace to a great advantage, which has not been done, as we are aware of, at least in its application for this purpose, which is to increase the heat in the oven around the cylinders, so that whatever condensation takes place therein from steam arising from the moisture or dampness of the grain

while drying is quickly absorbed or dried by the heat from this source, which, in addition to the heat given by the hot air, greatly facilitates the drying of the grain. To accomplish this the smoke-pipe from the furnace is connected to flues arranged around, under, and between the cylinders in the oven. The products of combustion, after passing through the flues, are finally discharged from a pipe connected to the oven.

Another feature of our invention consists in returning or passing off from the oven to the fire box of the furnace the hot air and volatile oil or other matter that is more or less emitted from the grain while drying, which, instead of being discharged from the oven, as is generally the case, we make use of to assist combustion in the furnace, and thereby facilitate the heating of the ring-tubes therein much sooner than otherwise, and it will thus be seen that economy is had in the use of fuel.

To enable any one skilled in the art to make and use our invention, we will proceed to describe its construction and operation.

We construct a furnace, *A*, of a cylindrical form, and convex at the upper portion of it, this shape being determined upon as the most suitable for the purpose designed: Within this furnace we construct a series of ring-tubes, *a*. (See Figs. 2 and 3.) There may be three or four, or more, as the circumstances of the case may require. The tubes are of a suitable size in diameter, and communicate with one another through a series of vertical tubes, *a'*, (three or more, as may be deemed necessary,) extending from the grating or fire-box of the furnace (see Fig. 2) to the under portion of the upper ring-tube. The vertical tubes constitute a part of the ring-tubes, being formed onto them in the casting, and have flange-plates to admit of packing, so that a secure and tight fit may be had to prevent the escape of the air, which is introduced at the terminus of the pipe *b*, connecting with the lower ring-tube by means of a force-pump, blower, or otherwise. The whole of the tubes are secured in the furnace by screw-rods *b'*, passing from the top side of the upper ring-tube down through the vertical tubes to the grating below, and fastened underneath by screw-nuts. Sufficient space is allowed between the ring-tubes to enable the fire to have the proper effect. These ring-tubes, by means of suitably-arranged valves or stops, may have the air pass in a certain or certain directions from the point whence it is admitted, for the better heating of it. Tubes may extend

across, as seen at letter *a'' a''*, Figs. 2 and 3, to present as much surface as possible to the heat.

Between the furnace and oven is an air-chamber, B, (see Figs. 1 and 3,) for receiving the hot air from the furnace. The form of construction of this chamber may be convex on both sides, as will be observed in the above figures, or any other form that may be deemed best, so that it is of the proper capacity to receive the air. Connected to this chamber are four distributing-pipes, C, leading into an oven, D, and connecting therein with four longitudinal tubes, E, having jets or nozzles *e*, (see Figs. 1, 4, and 5,) from which the hot air is ejected onto the grain through wire-covered or perforated sheet-iron cylinders F, one of which is seen clearly at Fig. 4, showing position of tubes and jets. As hereinbefore remarked, the wire covering prevents a direct blast of hot air being given to the grain, and thereby prevents its being scorched or otherwise injured. The effect of the jets or nozzles with oblong openings or slits in their connection with the tubes is such as to concentrate the air at the openings, and thereby enable it to be applied very effectively to the grain in the cylinders, which being thoroughly agitated by the revolution of the same, the air is infused into every part of the cylinders, and the grain consequently dried rapidly and without injury. The tubes are arranged, one about midway in the rear of the upper cylinder and the other on the front, at or near the bottom. (See Fig. 4.) The position of the lower tubes are arranged vice versa to those of the upper.

The cylinders are constructed of longitudinal arms *c*, and secured to spiders *d* or short projecting arms from the shaft. (See Fig. 4.) The framing thus formed is covered with wire-cloth or perforated sheet-iron. The cylinders are so inclined that when the grain is placed in the upper one through the funnel-shaped pipe G (see Figs. 1 and 2) the agitation caused by the revolution of them sends the grain from the upper into the lower one by means of a connecting-pipe, *f*, between them, a semicircular plate, *g*, being formed around the lower end of the upper reel to catch it and convey it into this tube, the inclination of the lower one carrying the grain to the proper place to be disposed of.

Between the cylinders, or immediately under the upper one, is a flue, H, which extends around the upper end of the lower cylinder and along under the same, as in the above one, to the side of the oven next to the furnace, where it terminates in its connection with the smoke-pipe *h*, which extends over to the top convex part of the furnace. The smoke or products of combustion are discharged through the chimney-pipe I, connected to the oven, (see Figs. 1 and 2,) after the passage of same around in the flues from the furnace for increasing the heat in the oven, as herein alluded to in the foregoing part of this description.

The pipe J in the rear of the furnace and oven (see Figs. 1 and 2) is for passing off the

hot air and other matter from the oven to the fire-box of the furnace, to assist combustion, as also hereinbefore alluded to.

For the purpose of facilitating the passage of the grain through the cylinders when the same is damp and heavy, the inclination of the cylinders is increased by elevating the shaft of the upper one and depressing the lower one, which is done by either slipping the slides K up or down, the shafts being attached to them. If the grain is otherwise, the upper shaft may be depressed and the lower one elevated as occasion may require. To accomplish the depression or elevation of these shafts in a more practical manner than by the use of slides, above referred to, an eccentric ratchet and pinion wheel or a screw with lever may be used.

The arrows in the flues in the oven indicate the direction of the products of combustion and its discharge therefrom.

The arrows around the holes in the oven indicate the discharge of the hot air and other matter therefrom to the fire-box of the furnace.

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

1. The heating of air from a force-pump, blower, or otherwise in a series of ring-tubes placed within a cylindrical or other shaped furnace, and the application of it thereafter to the outer surfaces of the rotary grain-cylinders through perforated longitudinal tubes, substantially in the manner and for the purpose set forth.

2. The passage of the products of combustion from the furnace into the oven through flues for increasing the heat therein, whereby the condensation arising from damp or moist grain is quickly dried or absorbed, substantially in the manner and for the purpose set forth.

3. The passage of the products of combustion back again from the oven, together with the discharged hot air from the longitudinal tubes and whatever volatile oil or other matter that may be emitted from the grain while drying to the fire-box of the furnace, for facilitating the combustion therein, substantially in the manner and for the purpose as set forth.

4. The combination of the longitudinal tubes E with the flues H, whereby the hot air, in conjunction with the products of combustion in the oven, serves to give an increased heat therein, substantially in the manner and for the purpose as set forth.

5. The ring-tubes *a*, air-chamber B, distributing-pipes C, longitudinal tubes E, having jets or nozzles with oblong openings, smoke-pipe *h*, flues H, and pipe J, as constructed and arranged substantially in the manner and for the purpose as set forth.

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CHAS. L. STEVENS.

Witnesses:

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JOEL LEE.