

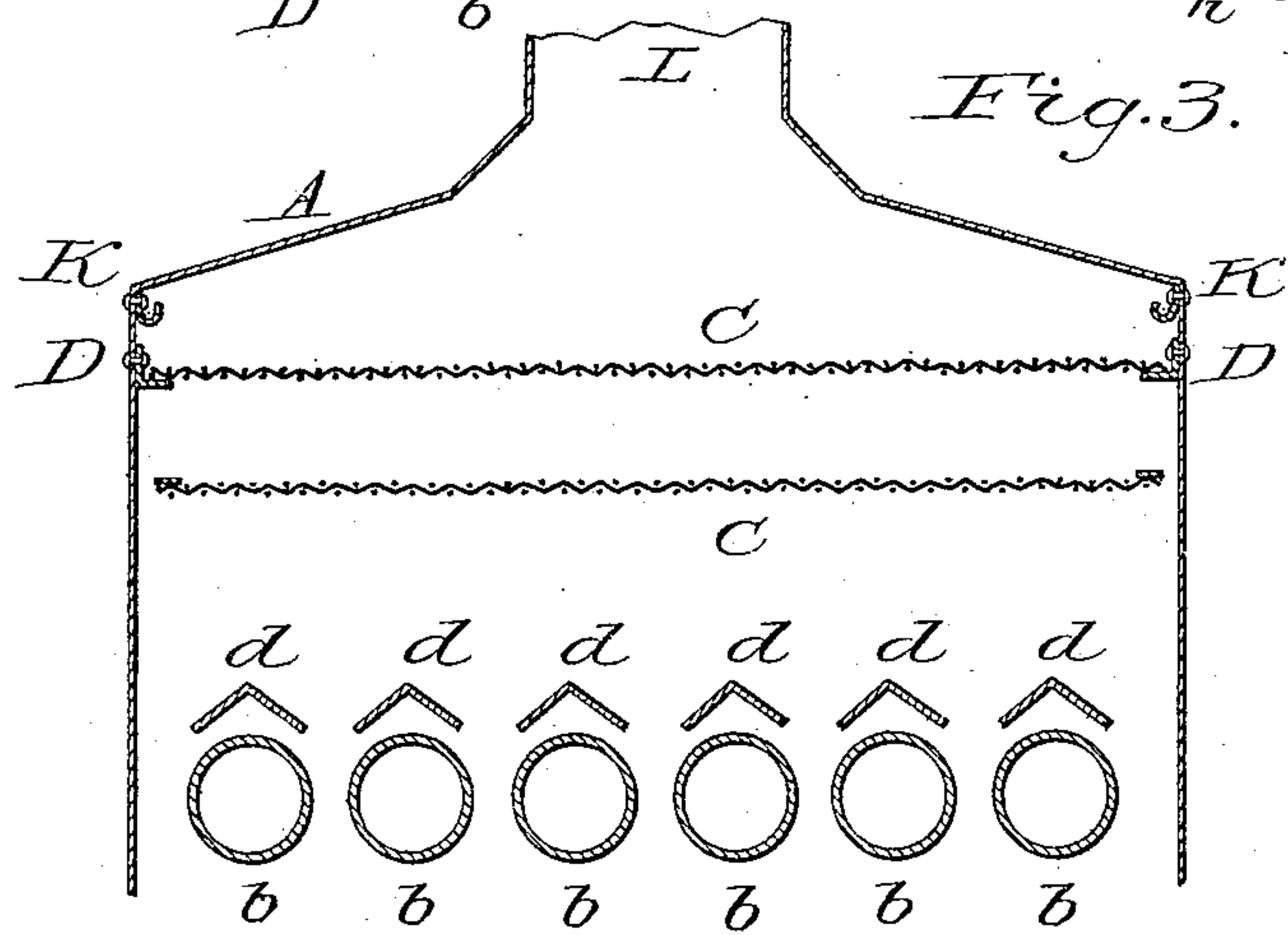
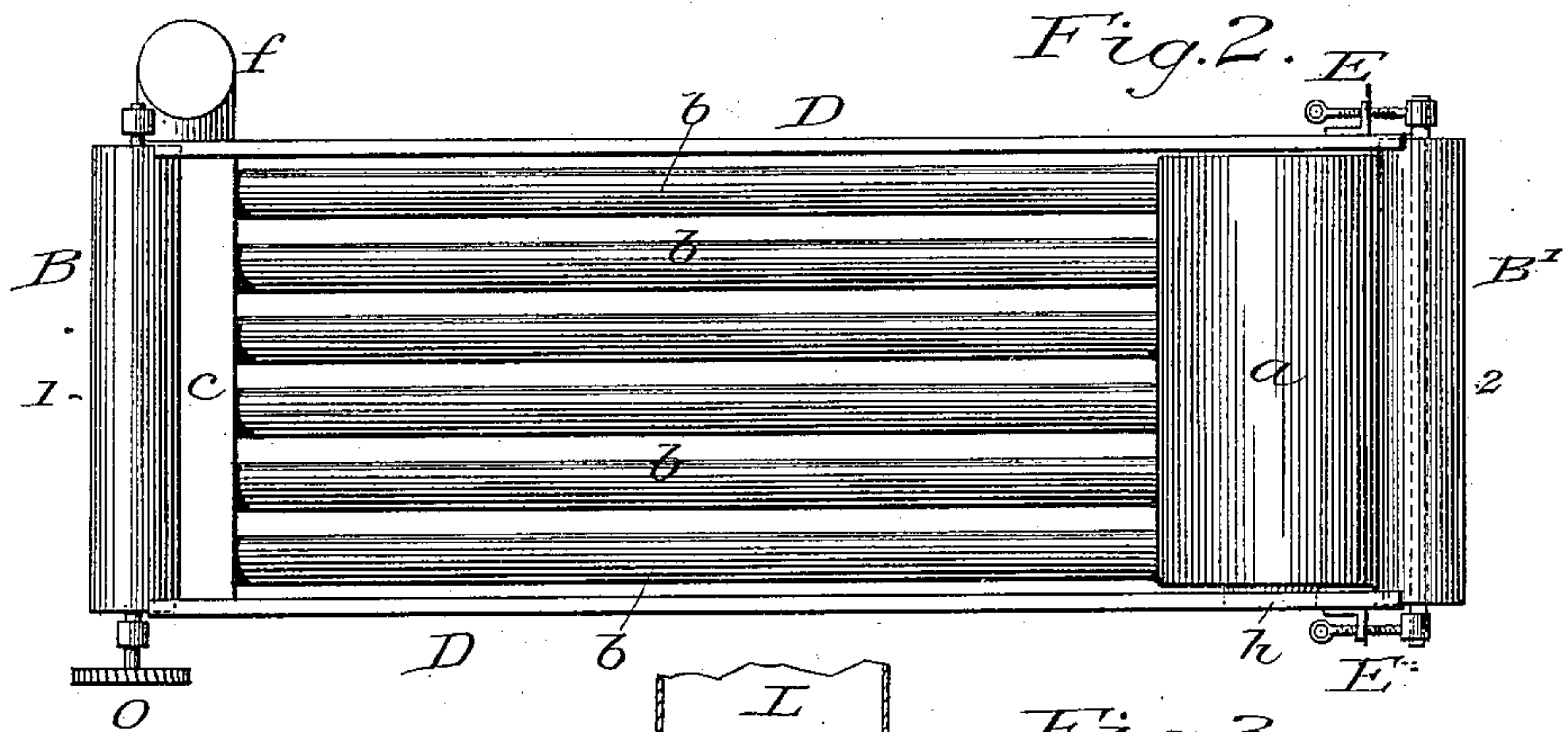
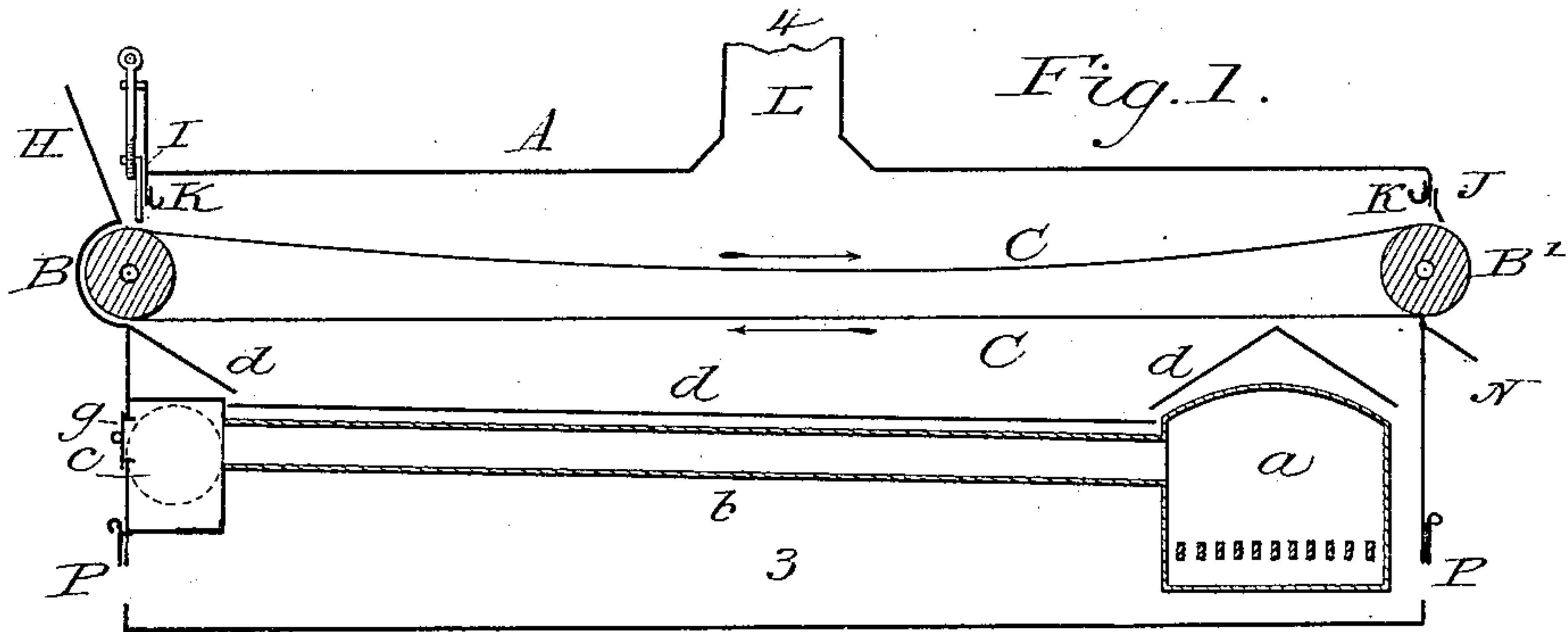
(No Model.)

S. E. WORRELL.

GRAIN DRIER.

No. 333,188.

Patented Dec. 29, 1885.



Witnesses:

Chas. Coyne.
Josie E. Green.

Inventor:

Stanley E. Worrell.

UNITED STATES PATENT OFFICE.

STANLEY E. WORRELL, OF HANNIBAL, MISSOURI.

GRAIN-DRIER.

SPECIFICATION forming part of Letters Patent No. 333,188, dated December 29, 1885.

Application filed June 18, 1885. Serial No. 169,040½. (No model.)

To all whom it may concern:

Be it known that I, STANLEY E. WORRELL, a citizen of the United States, residing at Hannibal, in the county of Marion and State
5 of Missouri, have invented a new and useful Machine for Drying and Cooling Grain, of which the following is a specification.

My invention relates to improvements in machines for drying and cooling grain and
10 other substance of a granular nature. Machines for this purpose, as heretofore constructed, have been very expensive, are of a cumbersome nature, require a large amount of power to operate, and skillful attendants,
15 while the discharged products are delivered from them in an irregular condition.

The object of my invention is to supply a machine at a moderate cost which is compact, convenient for transportation, easy to operate,
20 economical in the consumption of fuel and use of motive power, and that will produce even results.

I am aware that drying devices have been patented somewhat resembling mine in appearance, but widely differing from my invention in many important points which constitute the vital parts of a machine for this purpose—for instance, where drying-belts have been used the angle-irons for supporting the
30 sides of the belt have been secured to the case in a straight line, which produces much friction on the edges of the web and causes it to bag along its center. This naturally makes the product being operated upon work from
35 the edges toward the depression along the middle of the belt, thus producing an unequal thickness of material for the action of the current of air, and consequently causing unequal results.

40 Perfect work is only attained when the material to be dried or cooled is spread to an even thickness over the surface of the web. I accomplish this result in my device by giving the above-mentioned angle-irons a sag
45 only slightly less than that of the loaded drying-belt, which prevents the objectionable cross-bagging of the latter and reduces the friction and wear along its edges.

Heretofore in drying-machines of this class
50 using direct fire heat it has been very difficult to regulate the fire in the furnace so as to pro-

duce a continuous even temperature in the current of hot air. To overcome this difficulty in my invention, I construct the furnace and heating-tubes of metal of extra thickness, 55 which act as a governor upon the temperature of the air-currents as follows: The extra bulk of the metal absorbs and retains a large portion of the heat that is produced in the furnace by excessive combustion, which takes 60 place there just after the introduction of fresh fuel, and afterward gives it off as the fire grows less before it is supplied with another charge of fuel. Thus the drying process becomes very regular without requiring any 65 extra skill or attention on the part of the attendant.

Another defect in drying apparatus of this class as heretofore constructed has been that they leave an objectionable smell or taint to 70 grain or other substance of a delicate nature. This is produced by the material being dried, or its accompaniments coming into contact with the hot surfaces of the heating apparatus, thereby being scorched and creating a smoke 75 which in passing up through the material being operated upon conveys to it the injurious taste and odor. I obviate this trouble by covering the top of all the heating-surfaces with inclined smooth metal plates, upon which the 80 dust and trash collects and falls to the floor.

The gutters for collecting and removing the water condensed from the moist air in the machine is a new device. Heretofore this water has run or dropped down into the ma- 85 terial being operated upon and retarded the drying process. I construct the heating arrangement so that the soot and fine ashes carried along by the draft of the furnace are deposited where they can be conveniently re- 90 moved while the machine is in operation. This is evidently an advantage over the former method of construction, which requires the stoppage and cooling of the machine for the purpose of cleaning the interior of the 95 heating-tubes and smoke-pipes.

Having clearly explained wherein the herein-described machine differs from those heretofore constructed for a similar purpose, I will now describe how I attain the above-mentioned 100 results by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of the entire machine through the line 1 2, Fig. 2. Fig. 2 is a top view of the machine as it appears after the removal of the cover, drying-belt, and dust-catchers; and Fig. 3 is an enlarged cross-section of part of the machine on the line 3 4, Fig. 1.

Similar letters refer to similar parts.

The case A is constructed of sheet-iron with close joints, riveted or bolted to a frame of angle-iron well braced with diagonal rods at the corners. At the ends of this case are located the two revolving cylindrical pulleys or rollers B B'. The former is permanently journaled in boxes secured to the frame just mentioned, the latter in two sliding boxes which are varied in position by the tension screws E E. The endless drying-belt C, consisting of wire-cloth or other loosely-woven webbing of a non-combustible nature, is drawn around the pulleys just described, and moves in the direction of the arrows seen in Fig. 1. The two angle-irons D D, Fig. 3, are secured to the case A from pulley to pulley, not in a straight line, but have about the same sag as the upper or working belt when it is loaded with material during the drying or cooling process. These angle-irons support part of the weight of the belt, prevent the escape of air between the edges of the web and sides of the case, and strengthen the machine. The large pipe L connects with an exhaust-fan or other device for drawing a current of air. The gutters K extend entirely around the machine just under the cover or top, and connect with a number of U-shaped small pipes which convey the water that collects in these gutters to the outside of the machine, but permit no air to enter it through them. The furnace a and heating tubes b, which also act as smoke-conduits, are made of iron of unusual thickness, so as to retain the heat and equalize its radiation. The latter enter the soot-box c, that is connected to the smoke-stack f, in which is placed a damper for regulating the draft of the furnace. Covered openings g are made in the soot-box opposite the entrances of the tubes b, for removing the soot and ashes while the drying process is going on. The dust-catchers d, made of planished iron or other non-combustible material with a smooth surface, are supported by iron rods screwed or riveted to the top of the furnace and heating-tubes. A number of hand-holes are placed in the sides of the case, to provide free access for cleaning these dust-catchers. The openings P P, Fig. 1, extending entirely around the case near the floor, are for the admission of air for drying and cooling purposes. They are supplied with sliding gates for regulating the quantity of air admitted and its distribution about the heating apparatus. The feeding-hopper H, (shown in Fig. 1,) with the gate I, extends over the full width of the machine. The latter spreads the material being operated upon to an even thickness across the entire width of the web C. This gate or spreading-

board, as seen, is provided with a screw for varying the amount of feed and the depth of the material on the belt.

J is a flexible valve, which permits the finished product to escape from the machine, but prevents the admission of air at this opening.

N is an apron for directing the material into a sack or conveyer for removal.

The door h can be located at either end of the furnace. There is also a door at one end of the box c for removing the soot.

A worm, sprocket, gear-wheel, or pulley is secured to the shaft of the roller B at O, Fig. 2, through which motion is transmitted to the machine. If desired, the power can be connected to the shaft of the opposite pulley, B'.

A number of openings with closing-gates are placed in the top of the apparatus for watching the operation and cleaning the inner surface of the case and gutters.

For drying very damp substances which must be subjected to the currents of hot air for a longer period of time than material containing a small amount of moisture, I increase the length of the entire machine, and, to relieve the pulleys B B' of excessive strains, place a number of loose rollers or idlers under the belt C, which also reduces the injurious tension of the latter. When the material operated upon sticks to the web so as to not fall off by gravity as the latter passes around the pulley B', I place a stationary scraper or revolving brush under this pulley in contact with the belt, which forcibly removes any matter adhering to the latter.

When it is preferable to combine the drying and cooling process in one operation, I extend the case inclosing the heating arrangement only over about one-half of the length of the carrying-belt, the remainder of which is inclosed in a similar case containing no heating apparatus, and only air of a natural temperature is used for cooling purposes.

I do not limit myself to the exclusive use of a special furnace for producing the heat for my invention. This may be furnished by any other heating device or at any other location and be conveyed to my machine; or, if desired, steam can be used as a heating agent by passing it through a coil or nest of iron tubes located in the place occupied by the furnace and connections, illustrated in the accompanying drawings.

Having described the construction of the several devices embodied in my apparatus, I will now explain the operation and effects. The fire having been started completely, and motion imparted to the pulley B and exhaust-fan connecting with the pipe L, the air is drawn into the machine through the openings, P, where, after its temperature has been increased by coming into contact with the hot surface of the furnace and heating-tubes, it is drawn up through the meshes in the endless web C and passes out through the above-mentioned suction-pipe. The damp grain or other granular substance is fed into the hopper H, from

whence it is admitted into the machine by lifting the gate I. As the belt constitutes the bottom of the hopper and moves at a regular speed in the direction of the arrows, the feed
5 is continuous and the grain is carried upon the web to the opposite end of the case and out under the valve J, where it falls onto the apron N. As soon as the damp material has entered the machine the drying process is be-
10 gun by the hot current of air mentioned above passing up through the interstices between the granular particles. The high temperature brings the moisture to the surface of the grain, from which it is removed by the passing hot
15 air, which has a great affinity for dampness and large absorbing-power. This action continues as long as any moisture remains or until the grain is discharged from the machine in a dry condition. The warm air, after ac-
20 complishing its work, is heavily charged with dampness, and, coming into contact with the cool metal case, a considerable portion of its moisture is condensed and collected on the inner side of the cover in the form of water,
25 which drains into the gutter K and finds its way out of the machine. The air, in its passage through the grain, also removes some of the light particles of dust or trash, which, after passing through the exhaust-fan, are con-

veyed by the air-pipes to some convenient receptacle. The gates P are opened or closed so as to furnish air of an even temperature over the whole surface of the drying-belt.

To cool naturally heated grain or other hot substance of a granular nature with this in-
35 vention, the operation is the same as above described, except the heat in the furnace is omitted. When machines are required for the cooling process alone, of course no heating arrangements are supplied. 40

Having described the construction of my invention and the method of its application, I wish it to be understood that I do not limit myself to the precise details hereinbefore de-
45 scribed, as they may be varied without departing from the nature of my device.

What I claim as new, and desire to secure by Letters Patent, is—

In a drying-machine, a metal furnace covered by the inclined shields *d* and connected
50 with the soot-box *c*, containing the openings *g*, arranged and operated substantially as described.

STANLEY E. WORRELL.

Witnesses:

CHAS. CLAYTON,
THOS. H. BRANHAM.