

(No Model.)

3 Sheets—Sheet 1.

O. B. HARDY.  
DRYING APPARATUS.

No. 315,141.

Patented Apr. 7, 1885.

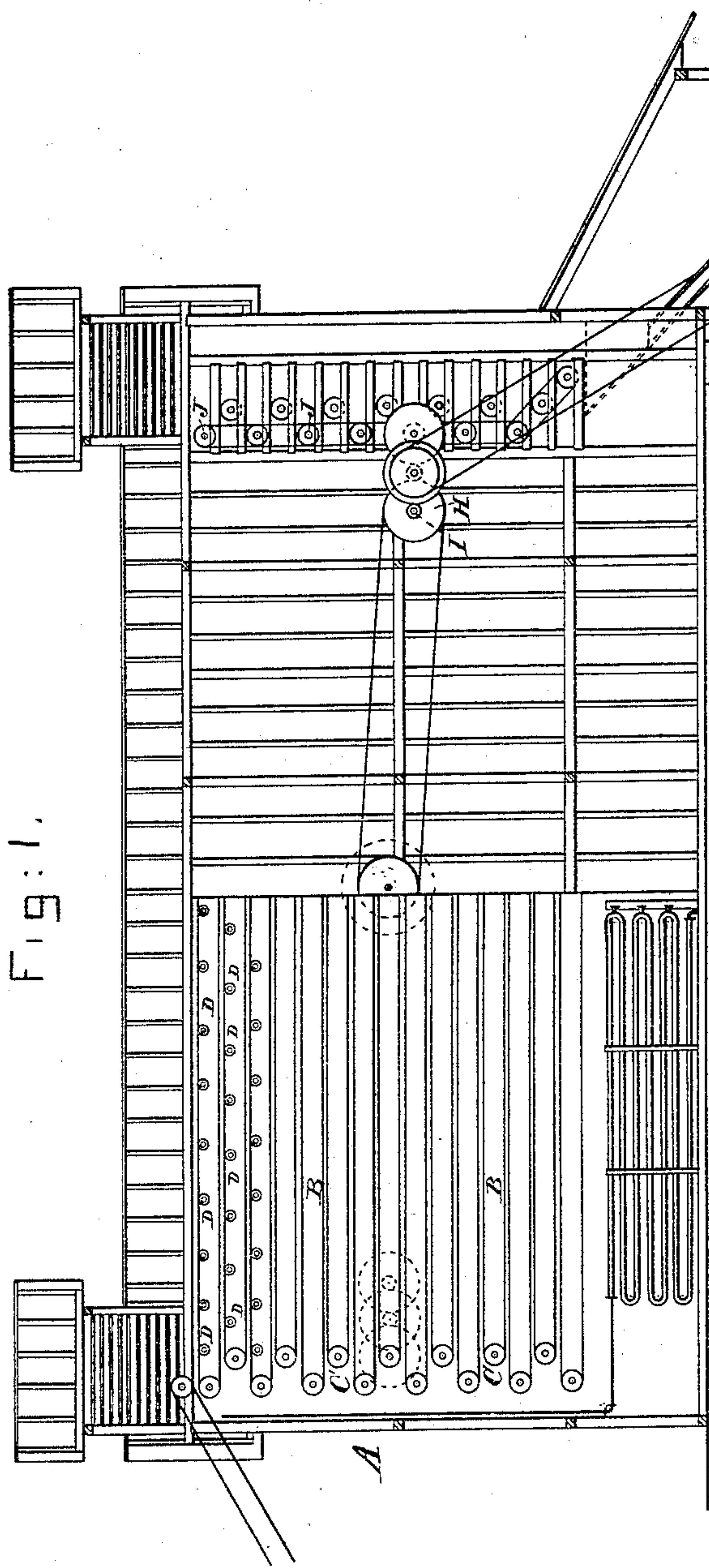
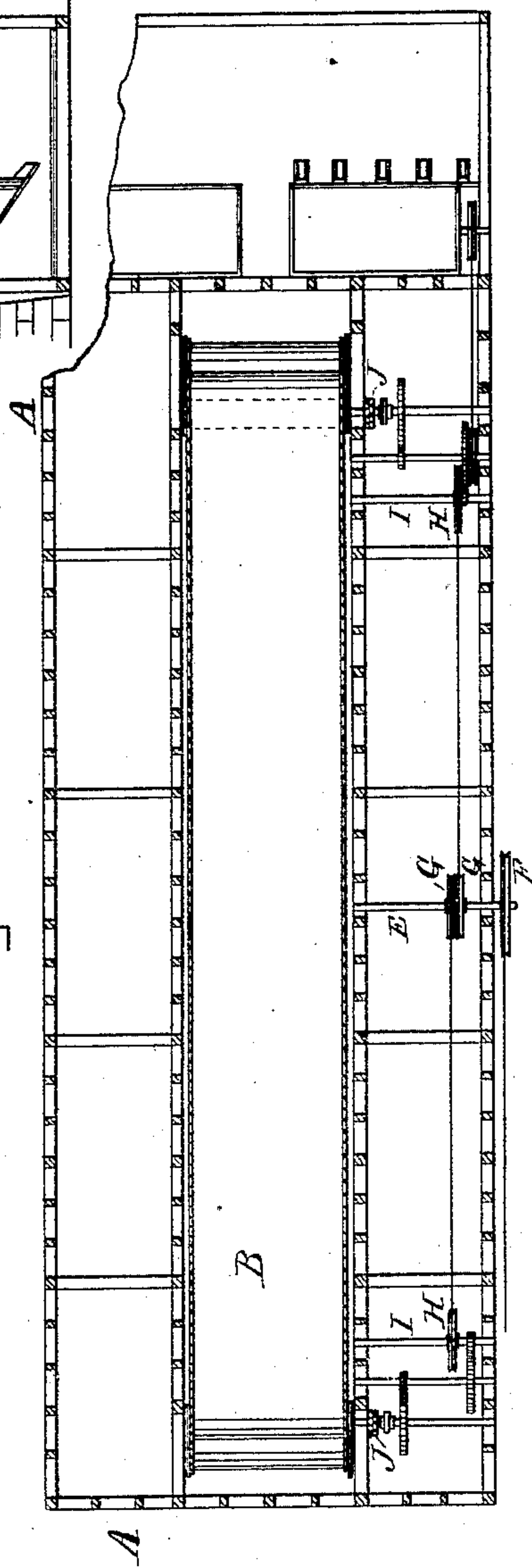


Fig: 2.



WITNESSES.

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*J. T. House*

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*By Dewey & Co.*  
*Attorneys*

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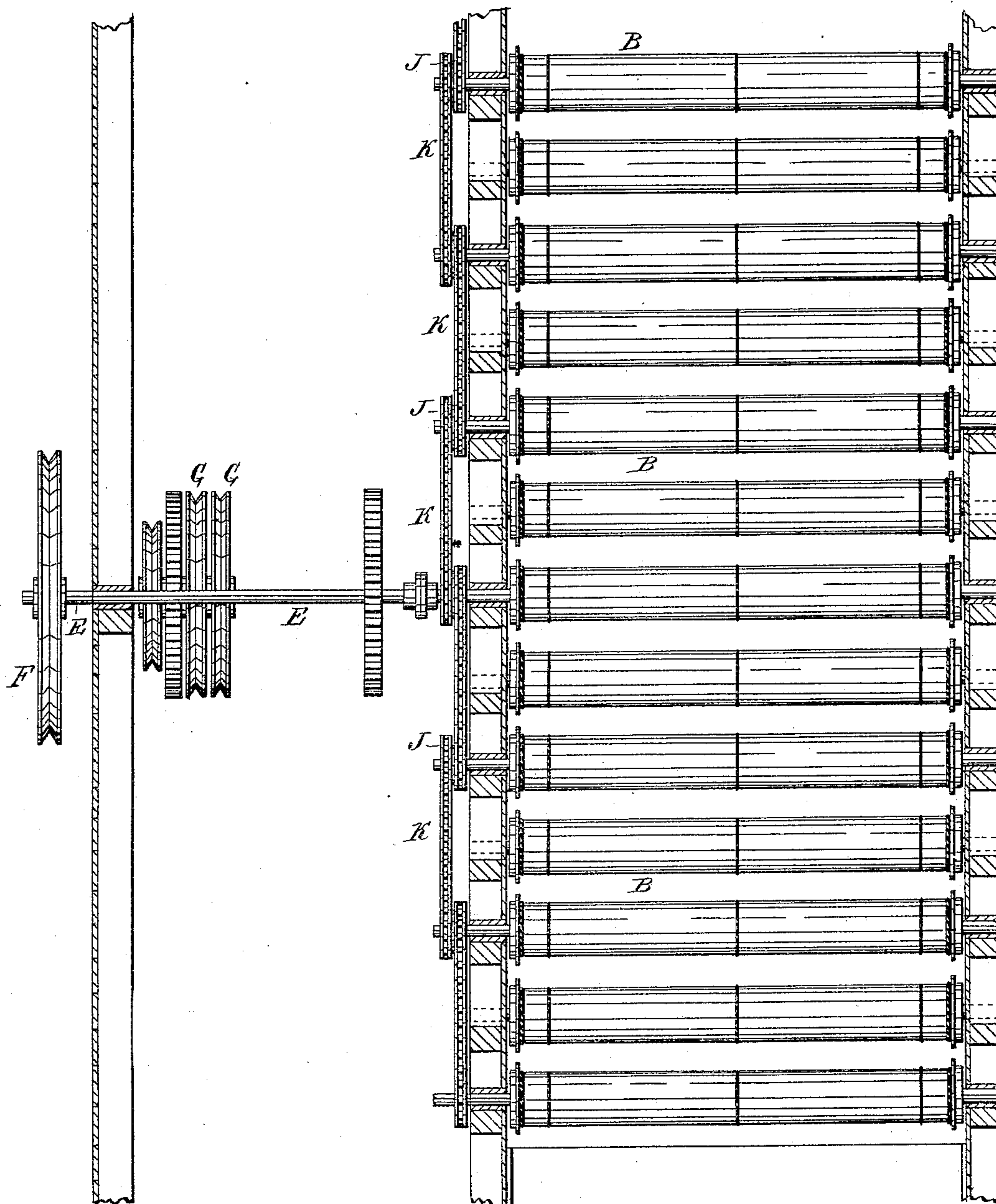
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*Fig. 3.*



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Fig. 4.

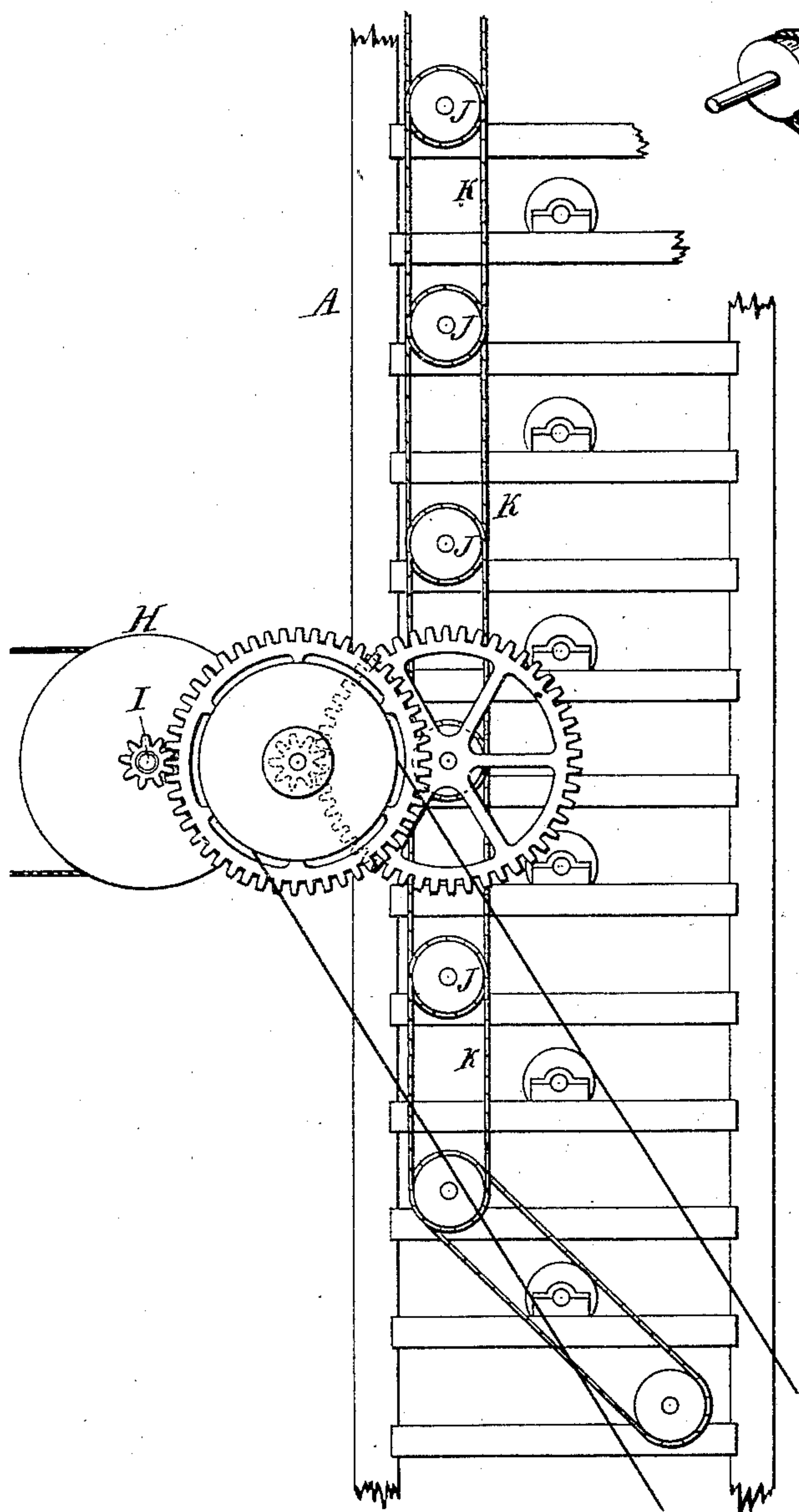
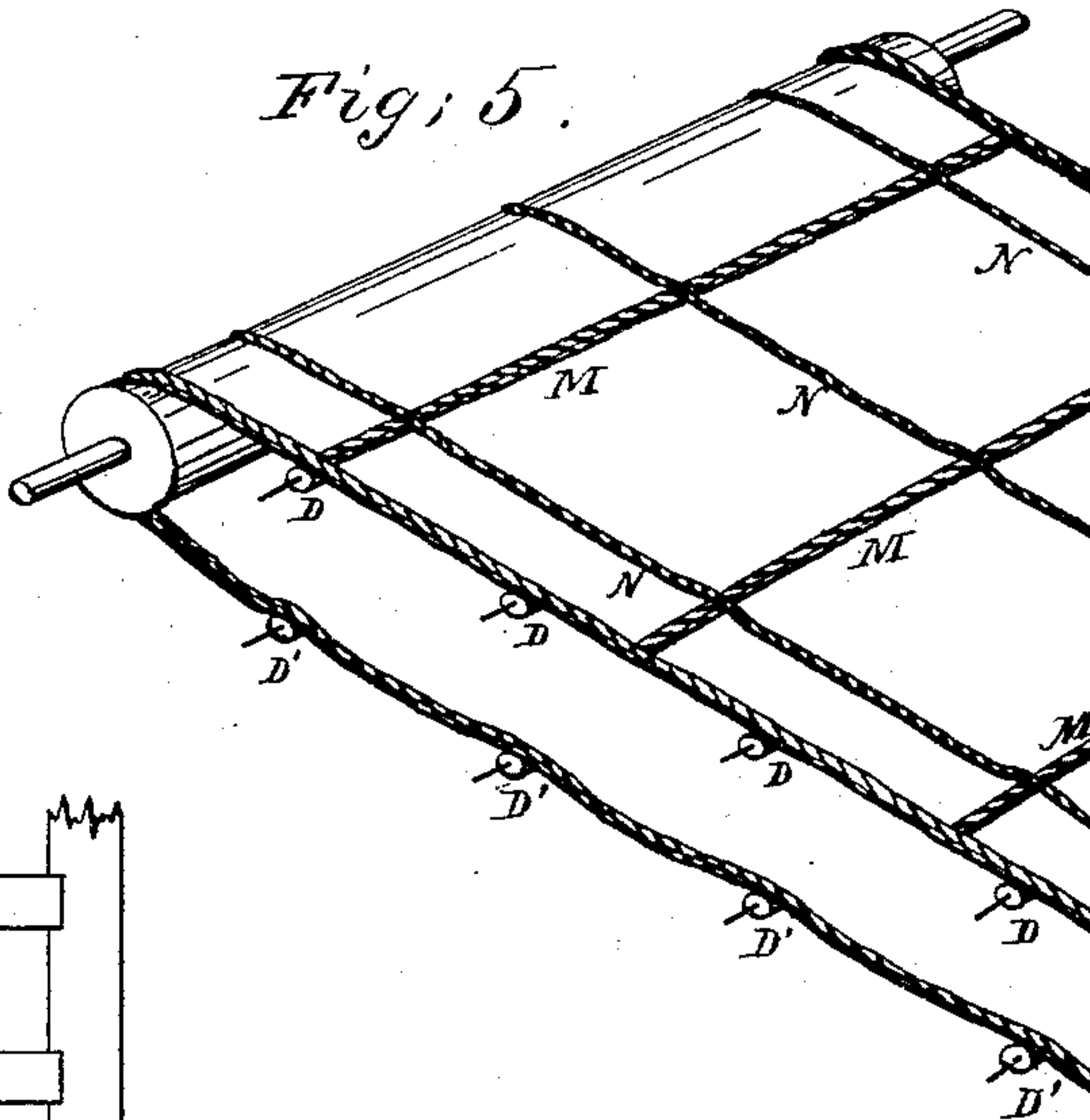


Fig. 5.



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# UNITED STATES PATENT OFFICE.

ORLANDO B. HARDY, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO THE  
GIANT POWDER COMPANY, OF SAME PLACE.

## DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 315,141, dated April 7, 1885.

Application filed February 11, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, ORLANDO B. HARDY, of the city and county of San Francisco, and State of California, have invented an Improvement in Drying Apparatus; and I hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to certain improvements in that class of drying apparatus in which a series of endless belts are arranged to travel one below another and alternately in opposite directions, so that the material falls from one belt to the next below and is carried backward and forward as it descends until it reaches the discharge from the lower belt.

It consists in certain improvements in driving the belts independently of each other, in a means for keeping them extended transversely, and in details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical section taken through the structure longitudinally, showing an edge rim of the belts and a portion of the driving-gear. Fig. 2 is a horizontal section. Fig. 3 is a vertical transverse section enlarged to show the arrangement of the driving pulleys, gear, and chains. Fig. 4 is an enlarged side view of a portion of one end of the apparatus, showing the driving pulleys, gears, and chains of that end. Fig. 5 is an enlarged view of a portion of one of the canvas carrying-belts, showing the means for keeping it extended and for supporting it.

In the machines hitherto constructed with a series of belts one above another the driving-rollers are located at the same end of the machine, and are driven by a single ordinary belt. The result is great friction and a heavy strain on the driving-belt, as well as upon the carrying-belts, which are moved by driving-rollers at their ends. To avoid these results, I first divide the entire motive power into two parts, so as to apply it at the proper end of each belt, and again divide the power at each end in order to apply it as nearly direct as practicable, and apply it to the rollers at their discharge end, so that the driving-rollers shall draw directly on the upper and loaded half of the belts, and, finally, use chain-belts to avoid

excessive friction and consequent strain and wear.

A is a structure or building within which a series of endless belts, B, is supported upon rollers C at opposite ends. The rollers at each end are journaled so that the second belt extends beyond the upper one at the end opposite the feed or supply apparatus. The third belt extends beyond the second at the return end, and so on to the bottom. Each alternate belt moves in a direction opposite to the one above, so that the material to be dried is carried alternately from one end to the other of the structure, dropping from one belt to another until it reaches the discharge end at the bottom. The belts being of considerable length, the upper or carrying part of each is supported upon small rollers D, journaled at suitable intervals apart, as shown. The lower portion of each belt may be supported by similar rollers to prevent its sagging so as to interfere with the next belt below. The upper or carrying portion is by the rollers divided into a succession of depressions, and the passage over the rollers agitates the powder or material and prevents its sticking or matting together. In order to drive these long heavily-loaded belts properly it is necessary to apply the power so as to draw the upper or carrying portion of each belt. Therefore each alternate belt must be driven by mechanism at opposite ends of the apparatus and independently of each other.

E is a shaft journaled in boxes preferably about midway between the ends of the structure and also about midway of its height.

F is a pulley secured to one end of this shaft and driven by a wire rope or other belt from the engine or other source of power.

G G are two similar pulleys upon the shaft E, connected by ropes or belts with the pulleys H H, which are fixed to shafts I, near the opposite ends of the structure. Each of these shafts has a pinion upon it, and by intermediate gearing the speed is reduced to the rate required for the belt-rollers. The right-hand roller-shafts for the belts whose upper halves run to the right are extended at one end, and have sprocket-wheels J secured to them, and adjustable link-chains K connect the first and



third of the shafts, the third and fifth, and so on to the top and bottom, so that every belt which discharges at the right will have power applied to draw it in that direction independently of the other belts and of each other. The belts which discharge at the left are in the same manner connected by chain belts, so that the upper or carrying portion will be drawn in that direction independently, and this causes all the belts to run smoothly and be driven evenly. The power, being applied from a central point, is transmitted to the ends by belts and gearing, as before described, and is then distributed upward and downward from the centers of the ends by the chain belts, so that the whole is really divided into four systems. The power thus required for each system is comparatively small, and the adjustments are more easily made.

In my apparatus the belts are about one hundred and twenty feet long, thus traveling about sixty feet in each direction, and are about six feet wide or more. They are made of canvas, and in order to prevent the lower non-carrying portion of each belt from sagging upon the upper part of the next belt below they are also supported by small rollers D', placed at short intervals apart. These long belts, when loaded, are apt to double or fold toward the center, and in order to keep them fully extended and make them run smoothly I fasten stiff ropes M transversely across them at intervals of about eight feet apart. These transverse ropes are preferably from an inch to an inch and a half in diameter, to give the requisite stiffness with sufficient flexibility,

and in order to make them pass smoothly over the lower supporting-rollers, D', smaller ropes N are secured longitudinally beneath them near the edges and also near the center. These latter ropes may be about one-half an inch in diameter. The edges of the canvas belts have ropes secured to them, as described in my former application, to keep them in proper shape.

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

1. In a drying apparatus consisting of a series of horizontal belts, means for driving said belts, consisting of pulleys or rollers over which the discharge end of each belt passes, and a centrally-located driving mechanism, with mechanism for transmitting motion to each roller directly, substantially as described.

2. In a drying apparatus, a series of belts placed one above another, a means for driving said belts, consisting of chain-wheels fixed to the alternate roller-shafts at one end, and similar wheels fixed to the other alternate shafts at the opposite end, and having chains connecting the wheels of each series, gearing by which the rate of speed is determined, and a central driving shaft and pulleys, with belts extending to the opposite ends of the apparatus, substantially as herein described.

In witness whereof I have hereunto set my hand.

ORLANDO B. HARDY.

Witnesses:

C. D. COLE,  
J. H. BLOOD.