

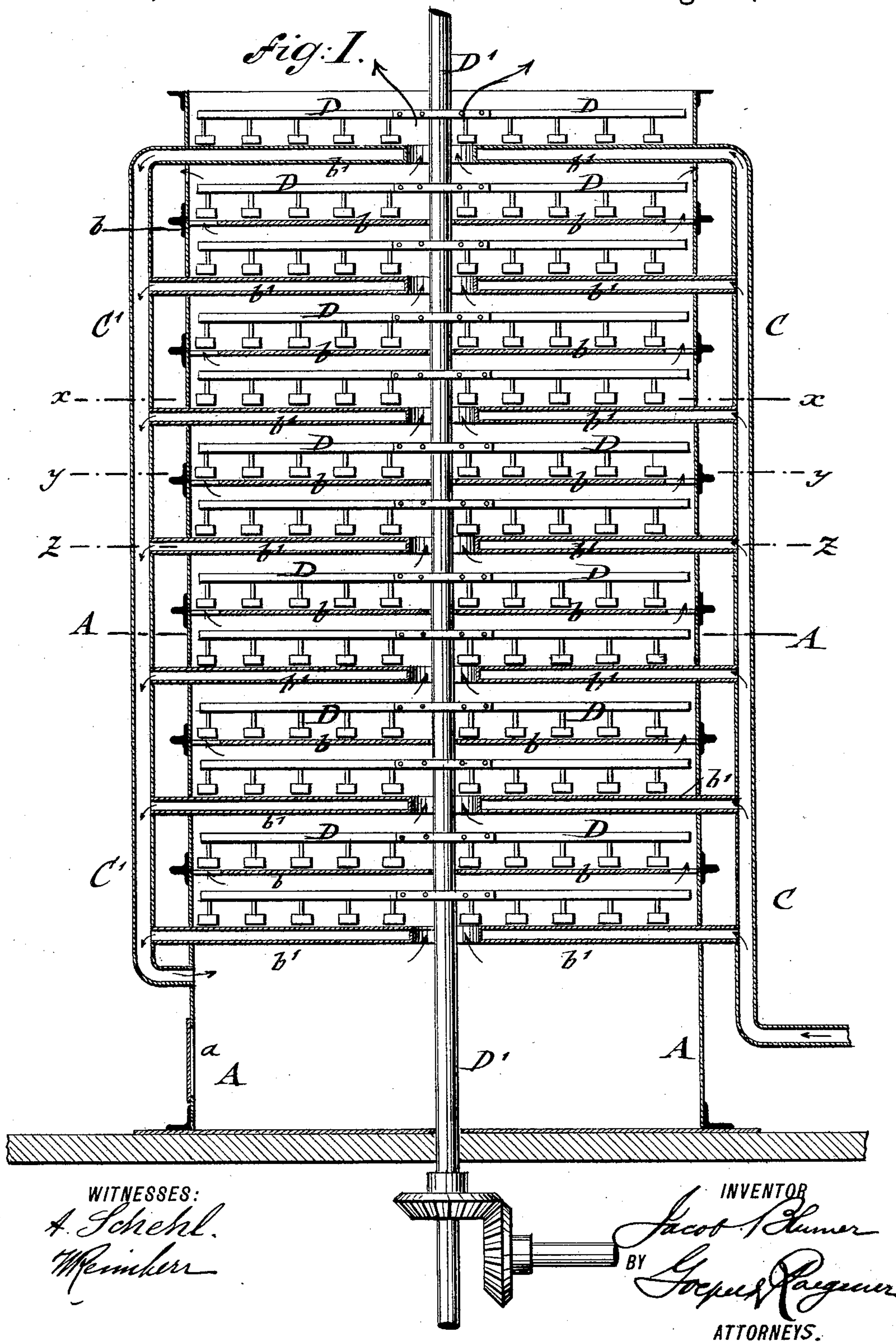
(No Model.)

2 Sheets—Sheet 1.

J. BLUMER.
DRYING APPARATUS.

No. 434,652.

Patented Aug. 19, 1890.



(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

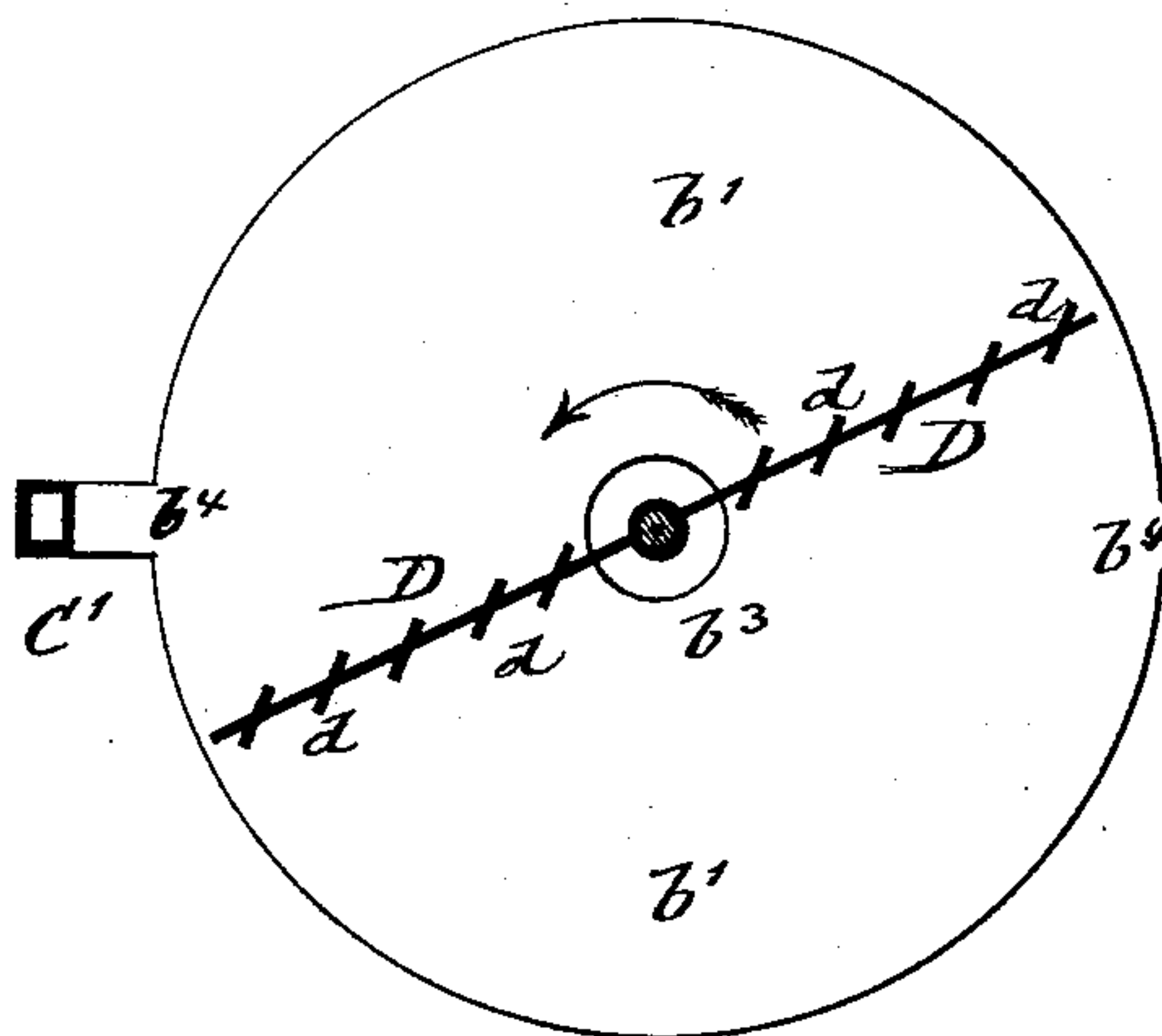


Fig. 3.

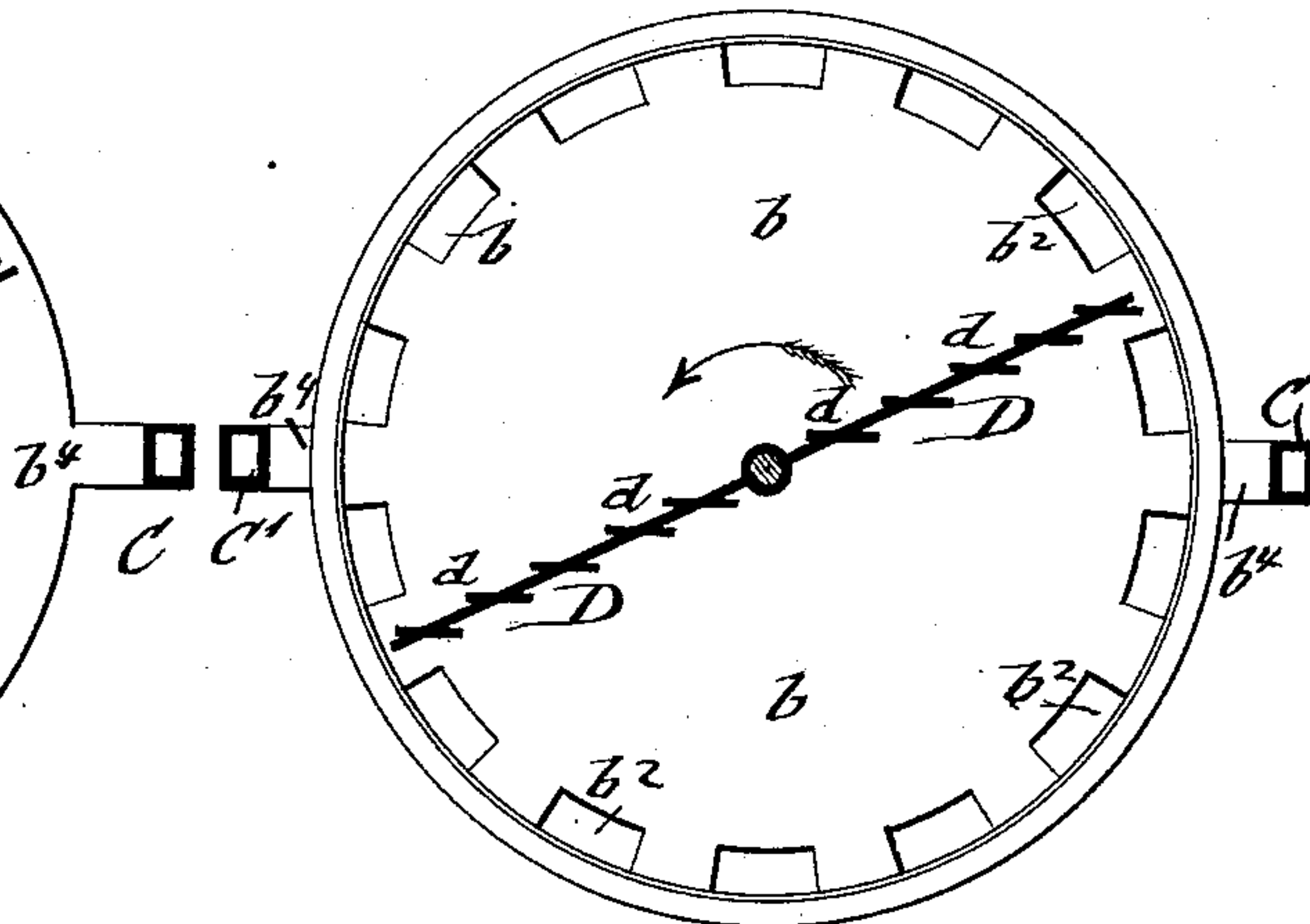


Fig. 4.

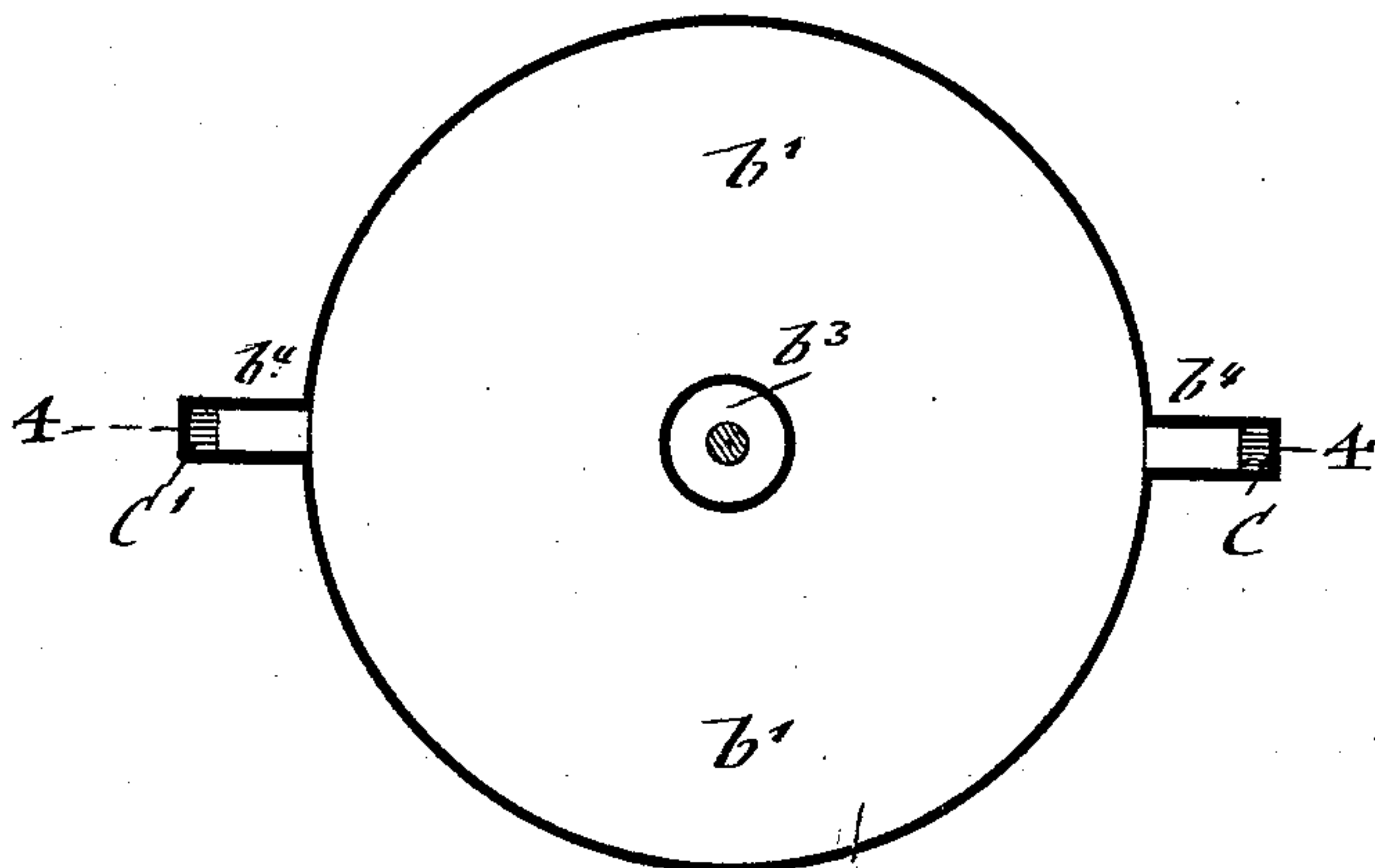
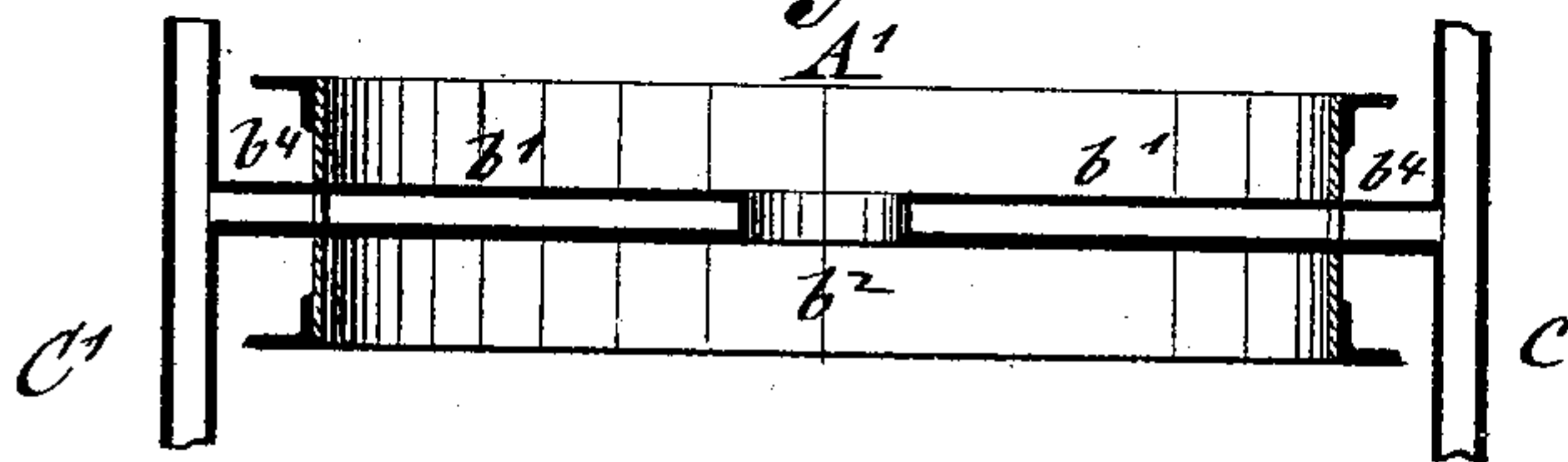


Fig. 5.



WITNESSES:

A. Schehl.
Meimken

INVENTOR

Jacob Blumer
BY *James H. Rogers*
ATTORNEYS.

UNITED STATES PATENT OFFICE.

JACOB BLUMER, OF BROOKLYN, NEW YORK.

DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 434,652, dated August 19, 1890.

Application filed February 27, 1890. Serial No. 341,923. (No model.)

To all whom it may concern:

Be it known that I, JACOB BLUMER, of Brooklyn, in the county of Kings and State of New York, a citizen of the United States, have invented certain new and useful Improvements in Drying Apparatus, of which the following is a specification.

This invention relates to an improved drying apparatus in which brewers' grains, distillers' slops, the residue of starch-factories, garbage, &c., may be dried by moving said materials in one direction through the drying apparatus, and subjecting them to the action of hot air which is passed in a counter-current over the said materials, so as to first subject them successively to an air-current of a gradually-increased temperature, whereby the moisture contained in the materials is gradually and effectively expelled.

The invention consists of a drying apparatus which comprises an exterior shell or casing that is open at the top for supplying the materials to be dried, a series of horizontal shelves in said casing, which are alternately provided with openings at the circumference and an opening at the center, and a series of rotary stirrers having inclined blades for moving the materials to be dried over said shelves alternately in inward and outward direction. Some of the shelves are formed of double walls and connected at diametrically-opposite points by short connecting-pipes with vertical pipes, through which the hot air for drying is supplied to the interior of the hollow shelves and to the interior of the casing, the hot air passing first through the hollow shelves, so as to produce the preliminary heating of the materials passing over the same, it being then conducted by the opposite pipe into the lower part of the casing, and then circuitously over the materials on the different shelves until it is emitted at the open top part of the casing, as will be fully described hereinafter, and finally pointed out in the claim.

In the accompanying drawings, Figure 1 represents a vertical central section of my improved drying apparatus. Figs. 2, 3, and 4 are horizontal sections of the same on the line xx , yy , and zz , respectively, Fig. 1; and Fig. 5 is a detail vertical section on the line 4 4, Fig. 4.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents a cylindrical or other casing or shell, which is formed of a number of sections A' , that are connected by angle-irons which are firmly bolted to said sections. The casing or shell A is open at the top and closed at the bottom. It is provided at the lower part with an opening a , having a gate for removing the materials after they have passed through the apparatus.

The casing A is divided into a number of cylindrical drying-spaces by a number of horizontal shelves $b b'$, of which each shelf b is provided with openings b^2 at the circumference, while each shelf b is provided with a central opening b^3 . The shelves b or b' , or all the shelves, are made of double walls, so as to form bottom spaces, which are connected by short pipes b^4 at diametrically-opposite points with vertical connecting-pipes $C C'$, of which the pipe C is connected to a blower or other suitable air-forcing apparatus, by which highly-heated air is forced through the pipe C and the double-walled shelves b' , and then conducted by the pipe C' into the lower part of the casing A. From the lower part of the casing A the heated air is conducted in a circuitous course through the central openings of the shelves b' and the circumferential openings of the shelves b , so as to pass over the materials on the shelves, until the air is finally passed off at the top part of the apparatus. The materials to be dried are supplied to the apparatus through the open top of the casing to the uppermost shelf, and are moved by rotary agitators D from one shelf to the other. The agitators D are formed of radial arms, to which inclined stirrer blades or paddles d are applied, as shown clearly in Figs. 1, 2, and 3. The inclination of the paddles moving over the shelf b is in one direction to the axis of rotation, so that the materials are moved in outward direction and dropped through the circumferential openings of the shelves b , while the inclination of the paddles moving over the shelves b is in an opposite direction to the axis of rotation, so that the materials are moved toward the central openings of the shelves, as shown respectively in Figs. 2 and 3. The stirrer-arms are firmly

attached to a central shaft D', that passes through central openings of the shelves b', said shaft receiving rotary motion by bevel-gears, as shown in Fig. 1, or other suitable transmitting mechanism. By the arrangement of the agitators described the materials to be dried are moved alternately in opposite directions over the shelves, so as to be dropped successively from one shelf to the other while being subjected during the passage through the apparatus, first, to the preparatory heating action of the double-walled shelves, and, secondly, to the direct action of the hot air that is forced through the apparatus.

The material to be dried is delivered to the top part of the casing A, where the agitators spread the same by their paddles over the uppermost shelf b', said paddles moving it gradually toward the central opening, through which it drops onto the second shelf, over which it is moved by the paddles of the agitators in opposite directions, so as to be dropped through the circumferential openings b² of the same onto the third shelf, on which it is moved inwardly again to the central opening, and so on alternately from shelf to shelf until it arrives in a perfectly-dry state to the lower part of the casing and is removed through the opening of the same. The lowermost section of the casing is of a larger size, so that the material may be taken from this section at intervals or continuously, as desired. The hot air that is supplied to the apparatus heats up the material by its con-

tact with the double-walled shelves, and then by direct contact therewith, it being gradually subjected to air of increased temperature as it approaches the lower part of the casing, whereby the moisture in the same is fully removed and carried off with the air that is discharged at the top of the casing.

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

A drying apparatus composed of an exterior casing or shell open at the top, a series of superposed shelves provided alternately with openings at the circumference and with openings at the center, rotary agitators provided with paddles arranged at opposite angles of inclination toward the axis of rotation, so as to move the materials alternately in opposite directions over said shelves, some of said shelves being formed of double walls, a pipe for supplying hot air to the interior of the hollow shelves, and a pipe for conducting the air from said hollow shelves to the lower part of the casing, so that the heated air is first brought in indirect contact with the materials to be dried and then in direct contact with the same, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

JACOB BLUMER.

Witnesses:

PAUL GOEPEL,
W. REIMHERR.