

No. 679,452.

Patented July 30, 1901.

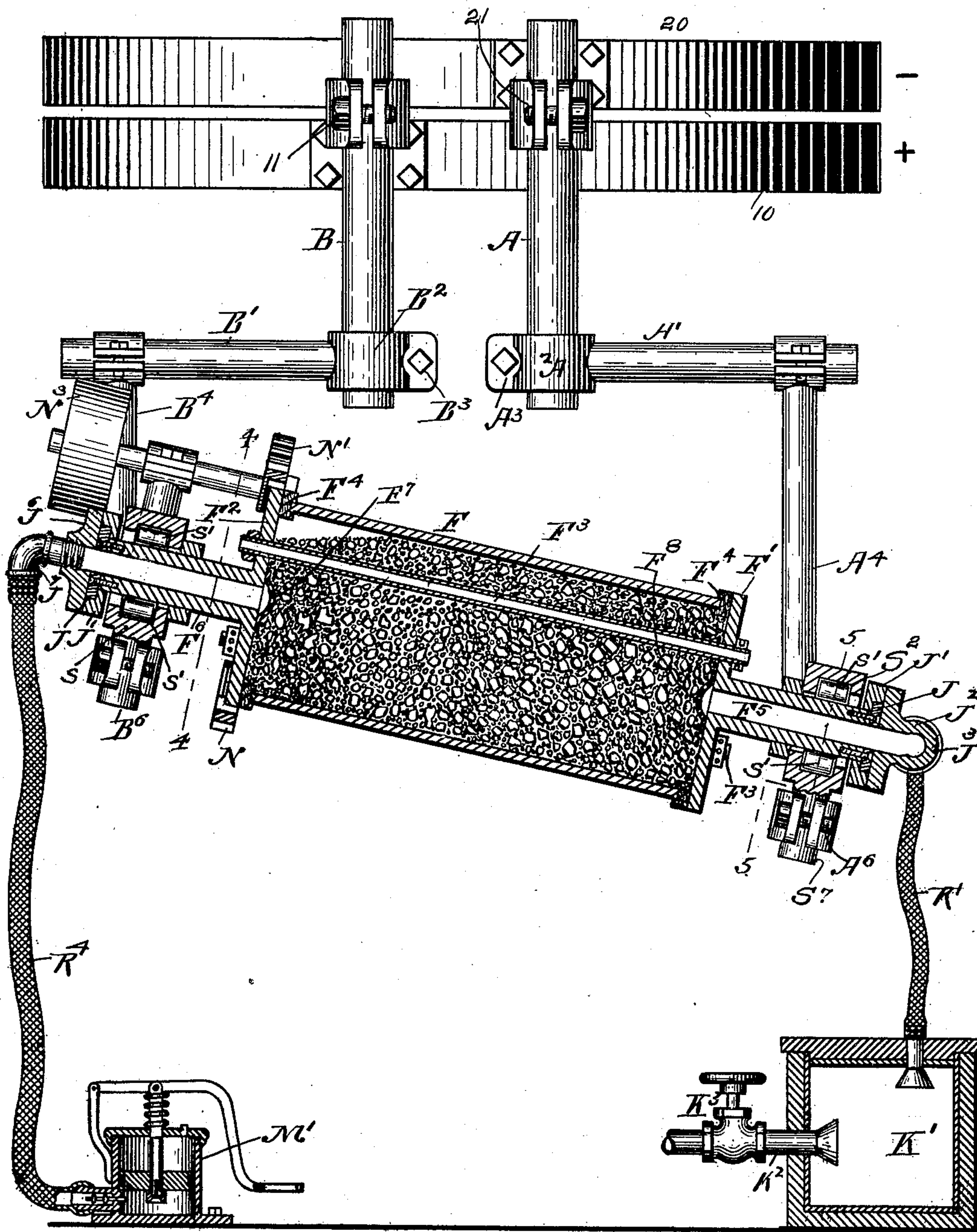
G. D. BURTON.

ORE ROASTING AND DISTILLING APPARATUS.

(Application filed Apr. 9, 1898.)

(No Model.)

4 Sheets—Sheet 1.



WITNESSES  
*E. F. Phillips*  
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FIG. 1.

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**No. 679,452.**

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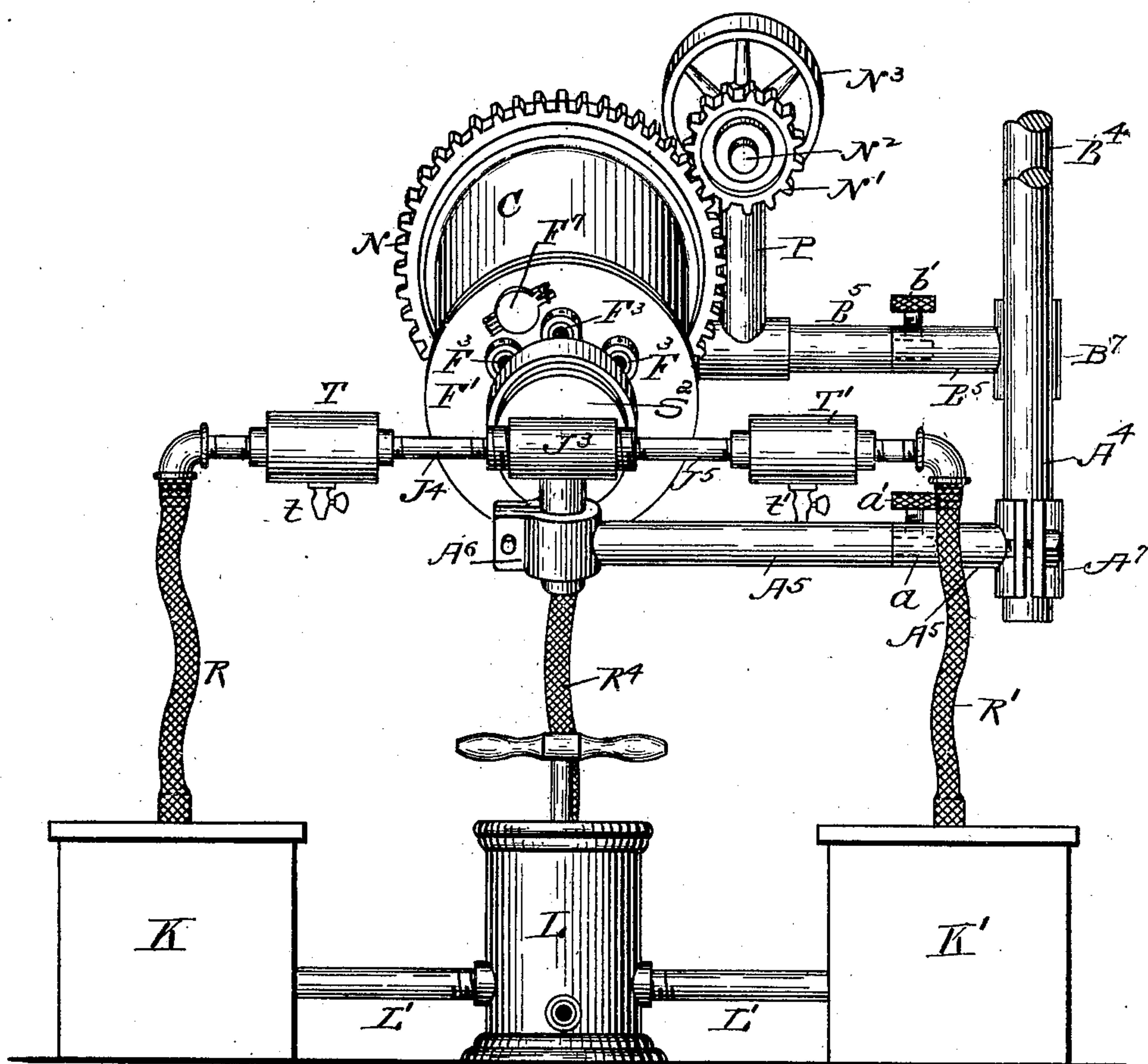
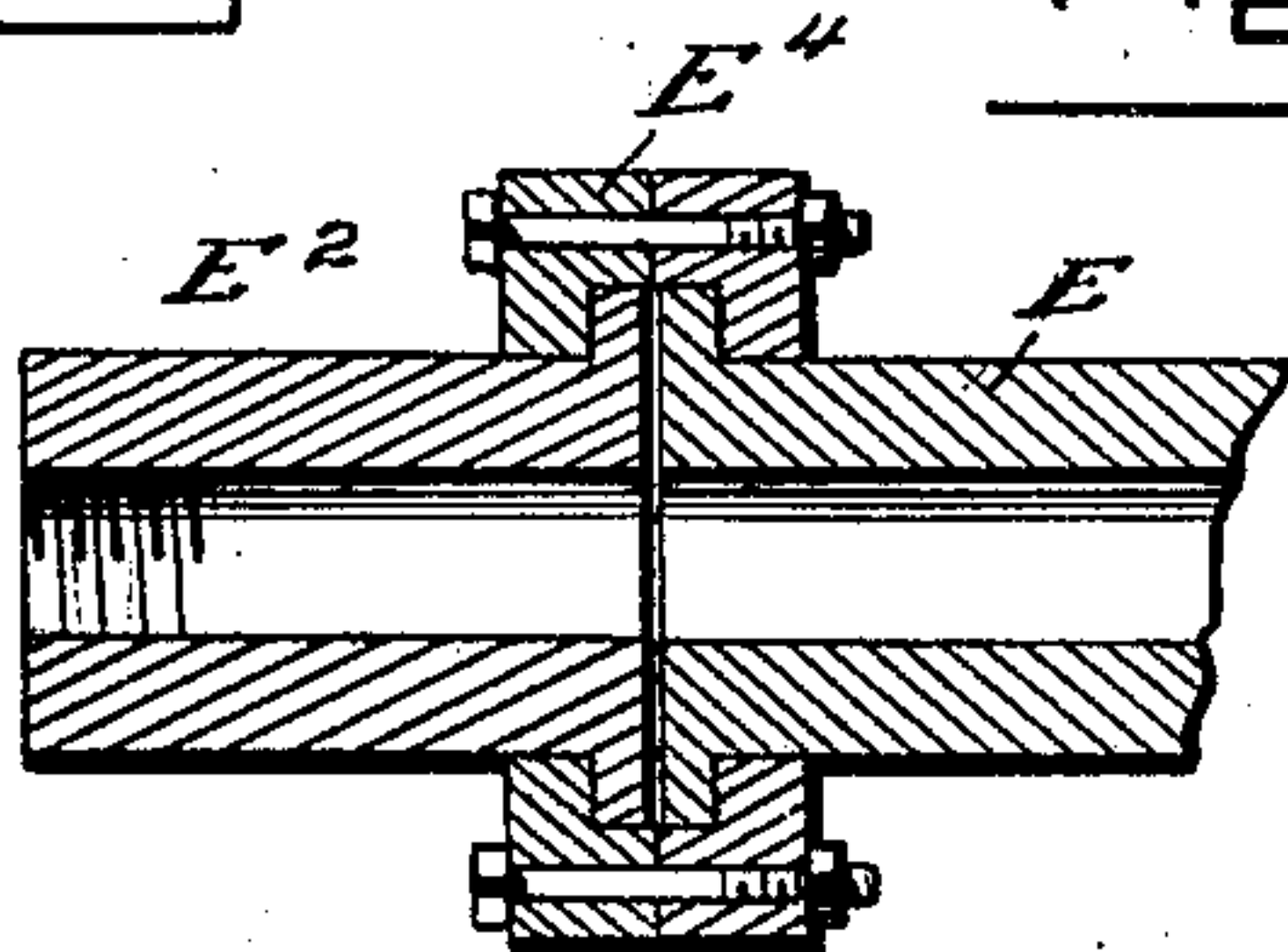


Fig. 8.

Fig. 2.



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## ORE ROASTING AND DISTILLING APPARATUS.

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(No Model.)

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Fig. 3.

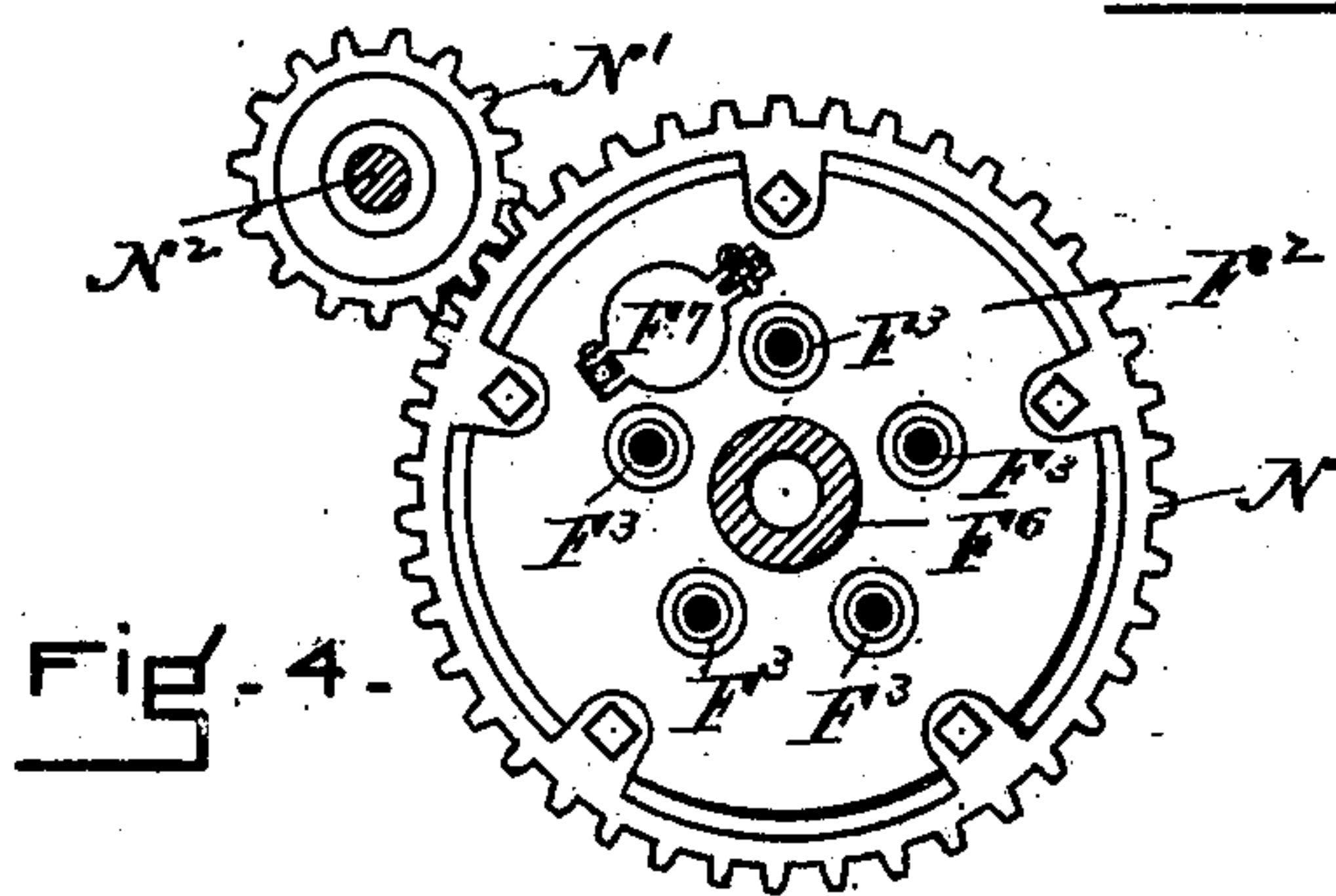


Fig-4-

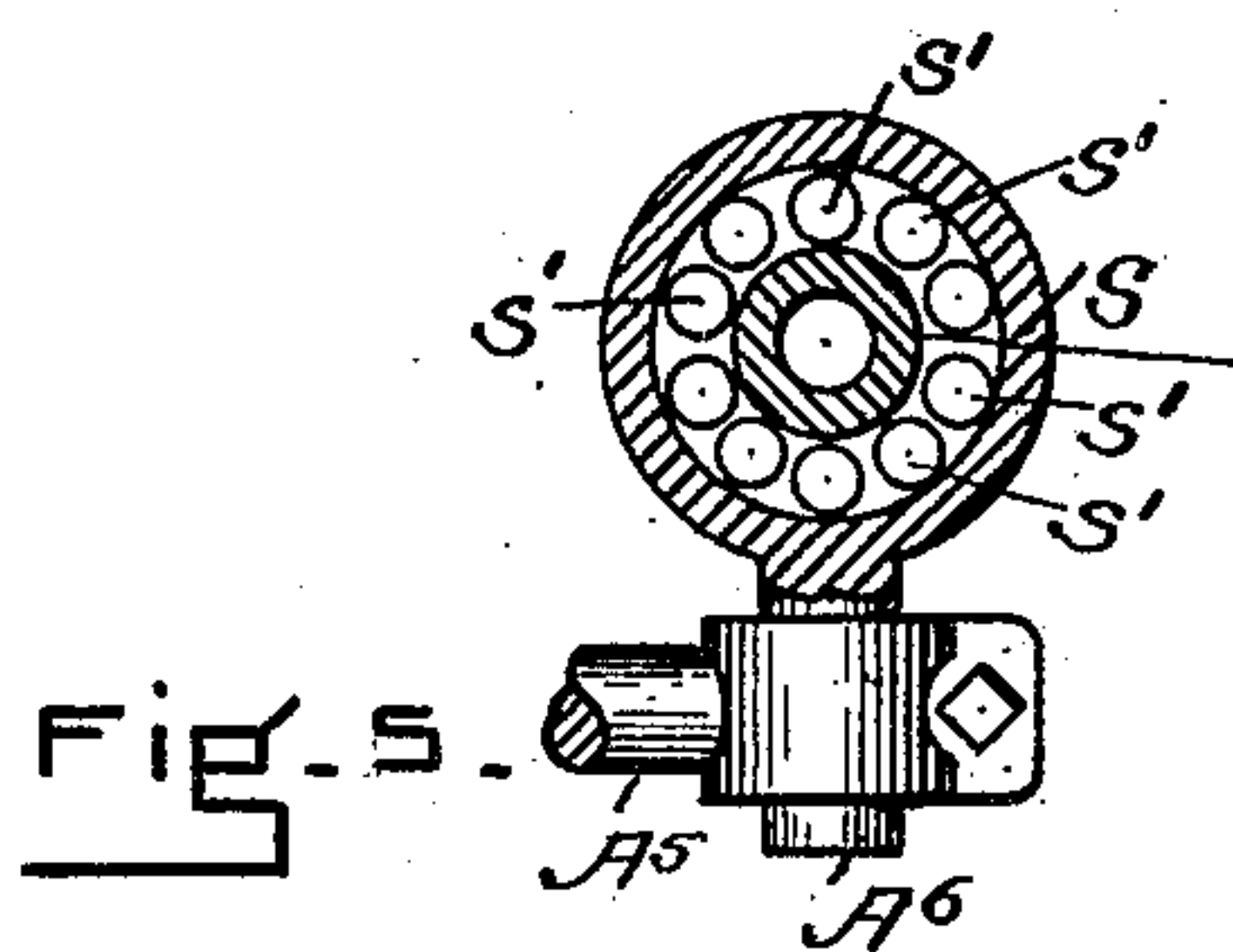


Fig. 5.

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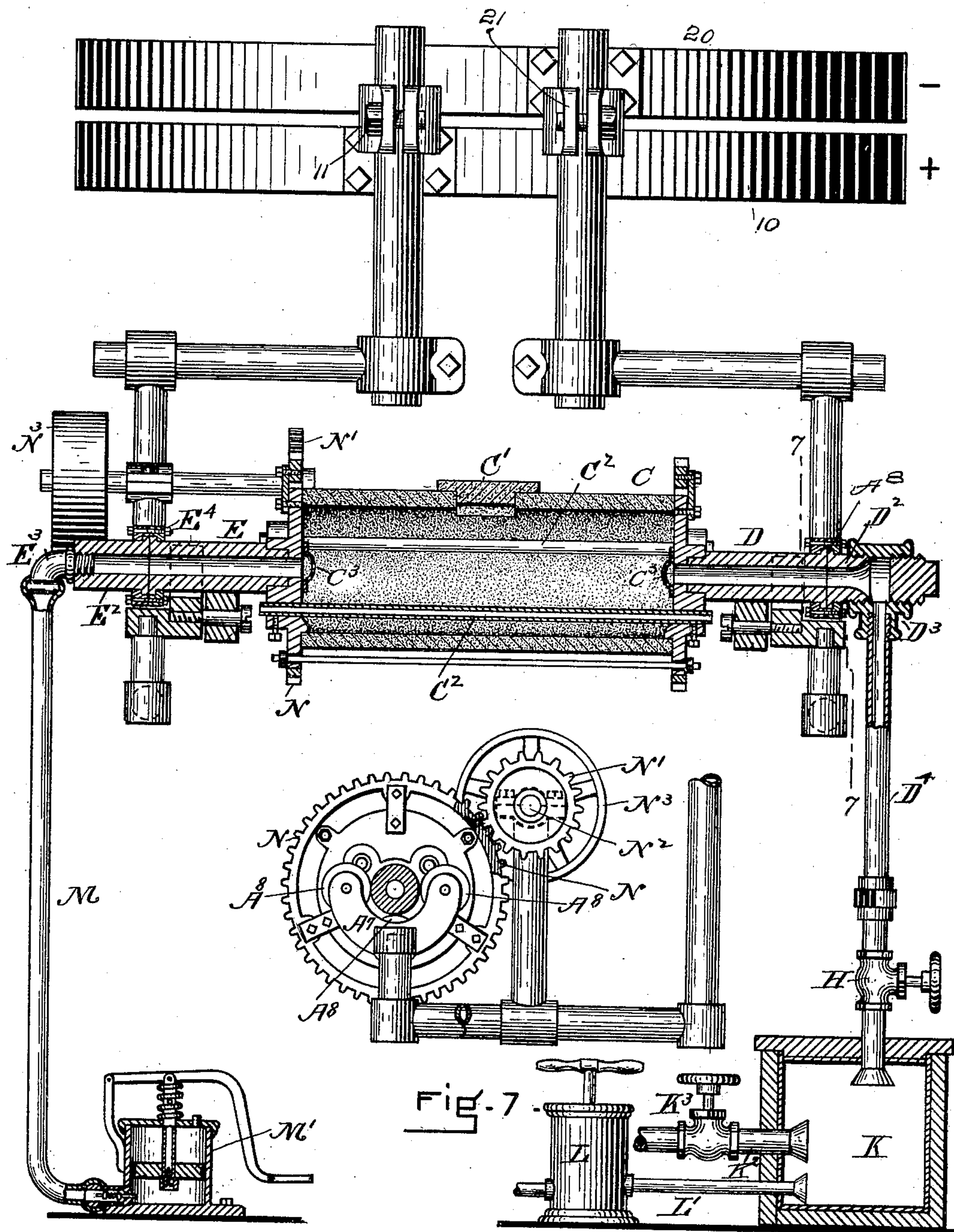
**G. D. BURTON.**

**ORE ROASTING AND DISTILLING APPARATUS.**

(No Model.)

(Application filed Apr. 9, 1898.)

**4 Sheets—Sheet 4.**



WITNESSES

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Fig. 6.

INVENTOR

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# UNITED STATES PATENT OFFICE.

GEORGE D. BURTON, OF BOSTON, MASSACHUSETTS.

## ORE ROASTING AND DISTILLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 679,452, dated July 30, 1901.

Application filed April 9, 1898. Serial No. 677,070. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE D. BURTON, a citizen of the United States of America, residing at Boston, in the county of Suffolk, in the State of Massachusetts, have invented certain new and useful Improvements in Ore Roasting and Distilling Apparatus, of which the following is a specification.

This invention relates to an ore-roasting apparatus in which the ore or substance to be treated is subjected to the heating action of an electric current which can be accurately controlled to regulate the temperature in which the ore or mineral substances to be roasted or treated may be kept under constant and uniform agitation and movement, so that all parts thereof will receive the same treatment, and in which currents of air or gas may be made to thoroughly permeate and traverse the mass of ore under treatment. Means are provided for drawing off and condensing or otherwise disposing of the gaseous products arising from the roasting process.

The invention relates particularly to a rotary furnace provided with interior hollow electrically-conductive metallic rods open at the outer ends of said furnace and adapted to convey an electric heating-current of large volume for reducing the substance under treatment, to resist breakage by the tumbling thereof within the furnace, to permit the passage of air through them to prevent overheating, and to expose the interior of the rods to inspection for determining the degree of heat. These rods are connected through the axles of the furnace or otherwise to an electrical apparatus by which the amount of electric current supplied can be accurately regulated, such as that described in United States Patents No. 475,232, issued to Burton, Eddy, and Briggs May 17, 1892; No. 475,184, issued to George D. Burton May 17, 1892, and No. 486,625, issued to George D. Burton November 22, 1892.

Figure 1 of the accompanying drawings represents a front view, partly in elevation and partly in section, of this improved apparatus. Fig. 2 represents an elevation of the right-hand side thereof. Fig. 3 represents an elevation of the left-hand side thereof. Fig. 3<sup>a</sup> represents in section tube-coupling used in this apparatus. Fig. 4 represents a section

on line 4 4 of Fig. 1, showing an end elevation of the rotary roaster. Fig. 5 represents a section on line 5 5 of Fig. 1, showing a section of one of the conductive ball-bearing joints for the rotary roaster. Fig. 6 represents a front view, partly in elevation and partly in section, of another form of the apparatus in which the rotary roaster is disposed horizontally. Fig. 7 represents a side view, partly in section and partly in elevation, of a part of the apparatus shown in Fig. 6, illustrating the means for rotating the rotary roaster. Fig. 8 represents, on an enlarged scale, a longitudinal section of the union joint between the axles of the rotary roaster and the gas-supply or exhaust-tube of the apparatus shown in Fig. 6.

The same reference characters are used in all the figures in the designation of identical parts.

Any suitable means for supplying the required electric heating-current of large volume and low voltage may be used in connection with this apparatus. One of the means indicated is that shown in the patents above referred to, which includes a transformer having a ring 10, which constitutes the positive secondary terminal thereof, and a ring 20, which constitutes the negative secondary terminal. The ring 10 is provided with a clamp 11, and the ring 20 with a clamp 21. Vertical rods B and A are suspended in the clamps 11 and 21, respectively, and horizontal rods B' and A', having clamps B<sup>2</sup> and A<sup>2</sup>, are connected to the lower ends of said vertical rods. These rods and rings are composed of copper or other suitable electroconductive material, and a rotary roaster is connected therewith.

In the form of apparatus illustrated in Figs. 1 to 3 the rotary roaster F is disposed in inclined position. A short conductive rod B<sup>4</sup> depends from the rod B', and a longer conductive rod A<sup>4</sup> depends from the rod A', and a rod B<sup>5</sup>, provided with a clamp B<sup>7</sup> at one end and a clamp B<sup>6</sup> at the other, extends horizontally from the lower end of the rod A<sup>4</sup>, and a rod A<sup>5</sup>, provided with a clamp A<sup>7</sup> at one end and a clamp A<sup>6</sup> at the other, extends horizontally from the lower end of the rod A<sup>4</sup>. The rod B<sup>5</sup> is made in two parts axially adjustable on each other, one of the parts having a socket provided with a set-screw b' and



the other a tenon *b*, held in said socket by said set-screw, and the rod *A*<sup>4</sup> is similarly constructed, one part being provided with a tenon *a*, held in the socket of the other part by a set-screw *a'*. This construction enables the axle-boxes for the roaster to be adjusted to suit the inclination thereof. Two journal boxes or housings *S* are supported by the rods *B*<sup>5</sup> *A*<sup>5</sup>, said boxes being provided with tangs *S'*, which are held in the clamps *B*<sup>6</sup> and *A*<sup>6</sup>. These tangs and journal-boxes are capable of conveying the desired heating-current and may be provided with ball-bearings, as shown in Fig. 5.

The rotary roaster shown in Figs. 1 and 3 comprises a steel cylindrical body *F*, provided with steel heads *F'* and *F*<sup>2</sup>, insulated from said body by rings *F*<sup>4</sup>, of asbestos or other insulating material. The head *F'* is provided with a hollow axle *F*<sup>5</sup> and the head *F*<sup>2</sup> with a hollow axle *F*<sup>6</sup>. These axles turn in the journal-boxes *S* and serve the multiple functions of supporting the roaster, conveying the electric current, introducing air and gases, and taking out fumes and by-products. The hollow axles are provided at their inner ends with screens *F*<sup>7</sup> *F*<sup>8</sup> to prevent the ore from entering the axles. These screens are preferably composed of metal, but may be made of any other suitable material.

Any suitable means may be employed for rotating the rotary furnace. The means shown for this purpose comprises a gear *N*, attached to the upper end of the cylinder *F*, a pinion *N'* on a short shaft *N*<sup>2</sup>, journaled in a standard *N*, attached to the rod *B*<sup>5</sup>, and a pulley *N*<sup>3</sup> on said shaft *N*<sup>2</sup>. A number of heating-rods *F*<sup>3</sup> extend through the interior of the rotary furnace from end to end thereof and serve to close the circuit, their opposite ends being in electric connection with the axles through the heads or otherwise. These rods convey an electric heating-current of large volume, which quickly raises the rods to a red or white heat, and the heat so developed is radiated and conducted to the contents of the furnace. The rods are preferably composed of hollow steel tubes open at their ends to permit circulation of air through them, to prevent overheating or melting thereof, and to permit inspection for determining the degree of heat. They are made of metal to resist the tendency to breakage due to the tumbling of the mass of ore in the rotary furnace.

Any suitable means are provided for supplying or forcing air or other gas to the rotary roaster. The means shown comprises a pump *M'* or other air-forcing device connected by a pipe *R*<sup>4</sup> with the outer end of the higher hollow axle *F*<sup>6</sup> by any suitable joint which permits the axle to turn.

Any suitable means are provided for drawing off from the roaster the gaseous products and floating particles. The means shown for this purpose comprises a coupling *J*<sup>2</sup>, connected with the outer end of the hollow axle

*F*<sup>5</sup> in such manner as to permit the latter to turn freely therein without leakage, said coupling having branches *J*<sup>4</sup> and *J*<sup>5</sup>. The branch *J*<sup>4</sup> leads to a condenser *T* and the branch *J*<sup>5</sup> to a condenser *T'*. A pipe *R* connects the condenser *T* with a receiver *K* and a pipe *R'* connects the condenser *T'* with a receiver *K'*. The condensers are provided with small cocks *t* and *t'* for drawing off any fluid that may collect in them. A suction pump or blower *L* is connected by suction-pipes *L'* *L'* with the receivers *K* and *K'* and serves to draw off the heavier by-products that collect in the bottom of said receivers. A pipe *K*<sup>2</sup>, provided with a valve *K*<sup>3</sup>, connects with the receptacle *K* and serves to conduct the lighter products that may collect therein to a further treatment or permits the escape thereof to the open air.

In the apparatus shown in Figs. 6 and 7 the rotary roaster *C* is disposed in horizontal position, and the body thereof is composed of fire-clay or other non-conducting material, whereby the insulating rings *F*<sup>4</sup> of the apparatus hereinbefore described are dispensed with. The axles *E* and *D* are hollow and made of separate pieces from the heads of the cylinder, and their inner ends are provided with screens *C*<sup>3</sup>. The body of the roaster is provided with a hand-hole or manhole *C'*, through which access may be gained to the interior for loading or discharging the roaster. This roaster is also provided with tubular rods *C*<sup>2</sup>, similar to the rods *F*<sup>3</sup> of the construction previously described. The axles are shown as supported on antifriction-wheels *A*<sup>8</sup>, journaled in brackets *A*<sup>7</sup>. By this means the furnace, though very heavy, may be rotated with great ease.

An air-pump or forcing apparatus *M'* is connected, by means of a pipe *M* and the elbow *E*<sup>3</sup>, with the axle *E*, and a receptacle *K* is connected with the axle *D* through the couplings *D*<sup>2</sup> and *D*<sup>3</sup> and pipe *D*<sup>4</sup>, the latter being provided with a valve *H*.

In the use of the apparatus shown in Figs. 1 to 3 the ore or other material to be treated is placed in the rotary roaster *F* and an electric current sent through the rods *F*<sup>3</sup> until the desired temperature is attained, and the heating action is continued and the intensity of the heat varied according to the work to be done or until the desired effect is produced, and during this heating the air or gas may be forced through the furnace by means of the air-pump *M'* and the expelled gases, vapors, and floating particles directed to proper receptacles and thereafter subjected to further treatment, if desired. The advantage of this apparatus is that the heat may be regulated or cut off entirely after certain stages are reached, and the by-products may be drawn off at different stages and ingredients quickly injected into the roaster. For instance, when using the apparatus for chloridizing ores containing copper, &c., chlorid of sodium is injected at various stages during



the process of chloridization. This apparatus may be used for the dry distillation of organic substances. For instance, gases either permanent or condensable into liquid and solid forms may be secured from animal matter. By the use of the hollow open-ended tubes not only the heating of the contents of the furnace and the cooling of the tubes are secured, but an operator may look through the tubes and by practice determine the degree of heat within the furnace. This is an advantageous and important feature, as the liability of overheating the tubes or contents of the furnace or the melting and destroying of the tubes is readily avoided by reducing the volume and pressure of the current before the tubes become overheated.

The other forms of the apparatus may be used in a similar manner.

I claim as my invention—

1. A rotary furnace for an ore-roasting apparatus, provided with interior hollow electrically-conductive open-ended metallic rods, and with means for connecting said rods with opposite electric poles.

2. A rotary furnace for an ore-roasting apparatus provided with electrically-conductive axles and with interior hollow open-ended metallic rods in conductive connection with said axles.

3. In an ore-roasting apparatus, the com-

bination of a rotary furnace provided with hollow electrically-conductive axles and with interior heating-rods in electric connection with said hollow axles, means connected with said hollow axles for passing an electric heating-current through said axles and rods, a pipe connected with one of said axles and provided with branches, receivers connected with said branches for collecting the by-products, and an exhausting device connected with said receivers.

4. In an ore-roasting apparatus, the combination of a rotary furnace provided with hollow electrically-conductive axles and with interior heating-rods in electric connection with said hollow axles, means connected with said hollow axles for passing an electric current through said axles and rods, a pipe connected with one of said axles and provided with branches, receivers connected with said branches for collecting the by-products, an exhausting device connected with said receivers, and an air-forcing apparatus connected with the other hollow axle.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

GEO. D. BURTON.

Witnesses:

E. F. PHILIPSON,  
GEO. STEINER.