

No. 633,278.

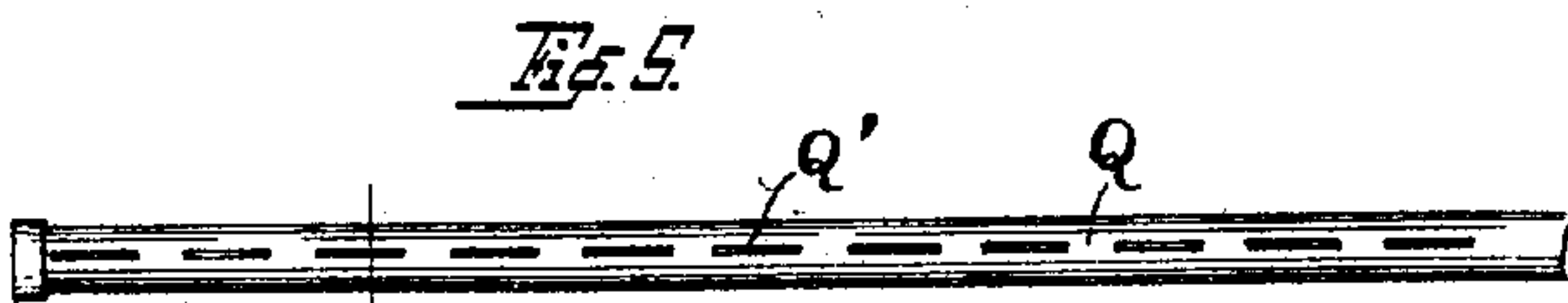
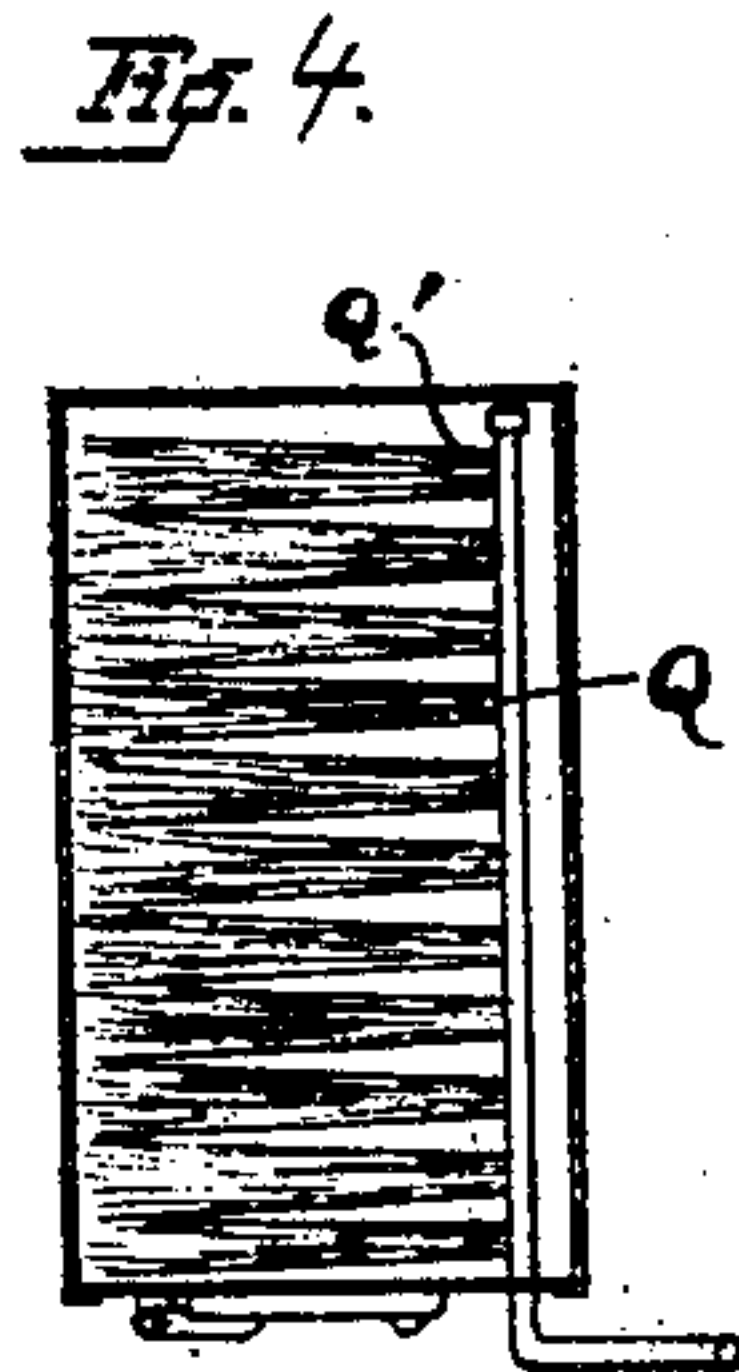
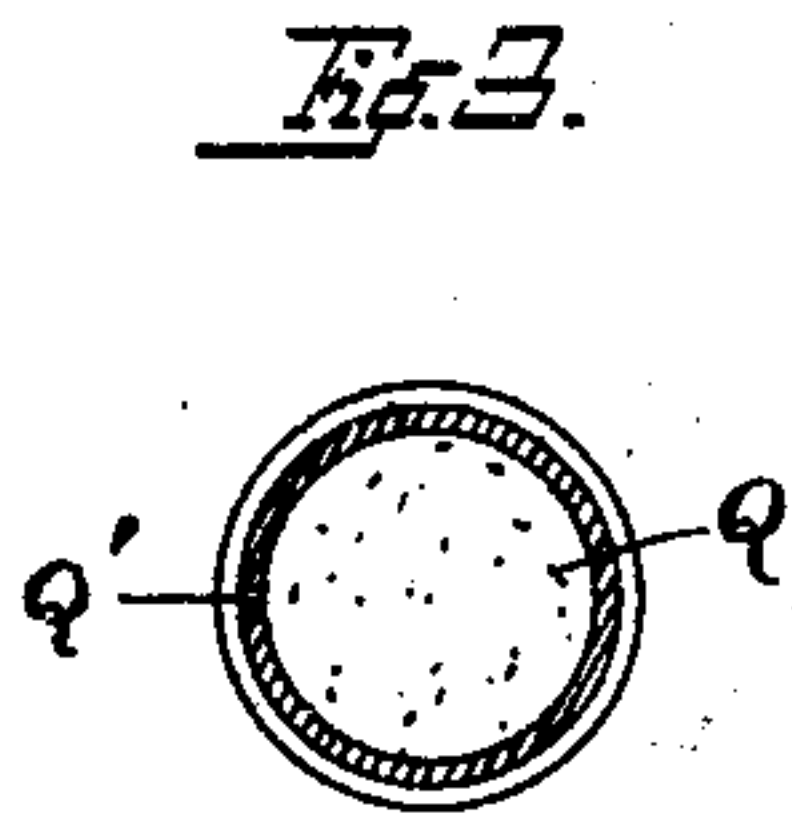
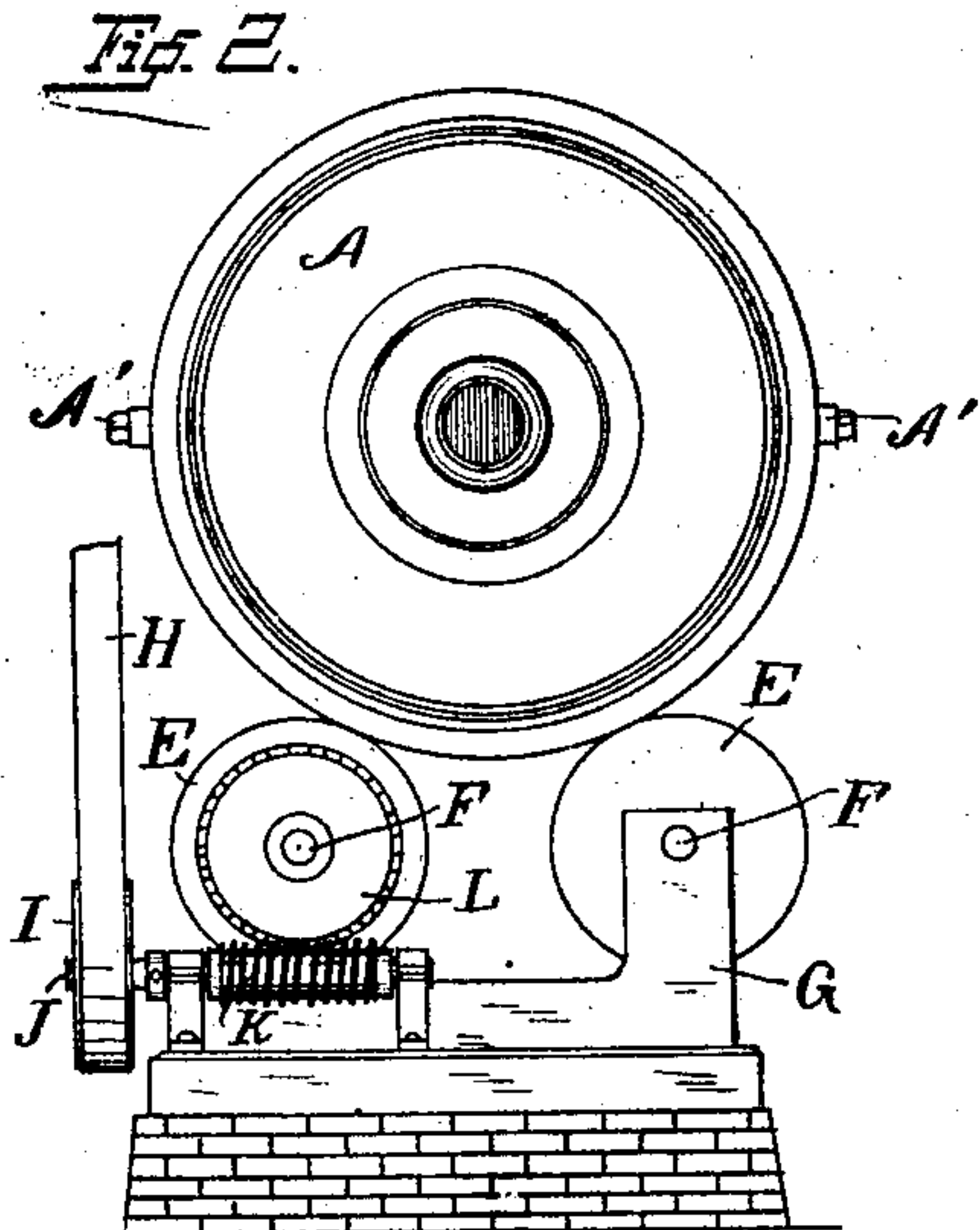
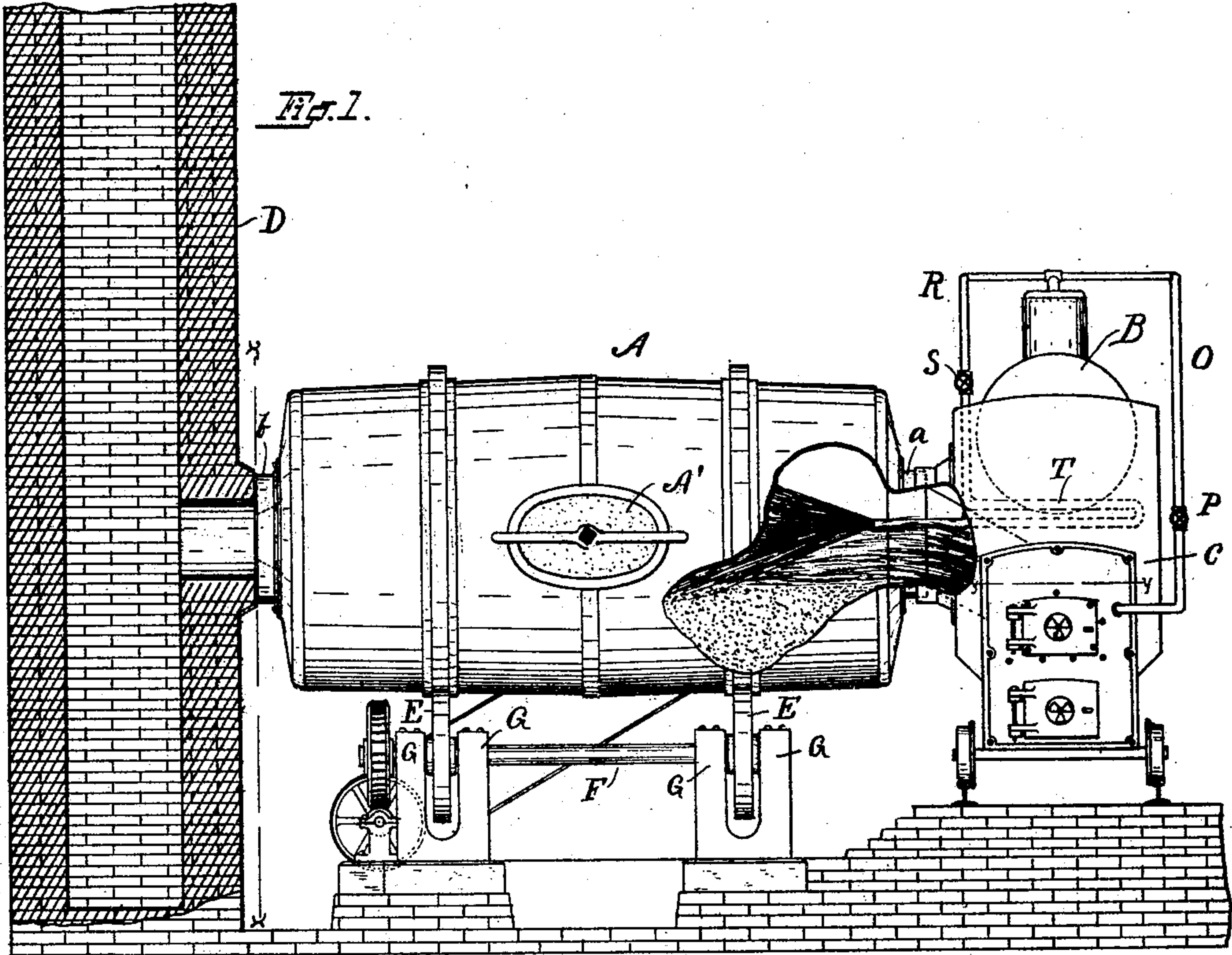
Patented Sept. 19, 1899.

R. A. STEWART.

APPARATUS FOR ROASTING REFRACTORY ORES.

(Application filed May 24, 1898.)

(No Model.)



Witnesses

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# UNITED STATES PATENT OFFICE.

ROBERT A. STEWART, OF CERRILLOS, TERRITORY OF NEW MEXICO.

## APPARATUS FOR ROASTING REFRACTORY ORES.

SPECIFICATION forming part of Letters Patent No. 633,278, dated September 19, 1899.

Application filed May 24, 1898. Serial No. 681,609. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT A. STEWART, a citizen of the United States, residing at Cerrillos, in the county of Santa Fé and Territory of New Mexico, have invented new and useful Improvements in Apparatus for Reducing Refractory to Free-Milling Ores, of which the following is a specification.

My invention relates to improvements in apparatus for reducing refractory to free-milling ores.

The object of my invention is to provide means by which the ore may be simultaneously roasted by the application of dry heat direct from a furnace and oxidized by the application of oxygen gas produced from steam direct from the boiler by superheating the same to a high degree of temperature, whereby the ore may be much more rapidly and economically reduced or converted from its refractory condition to free-milling ore than by other processes heretofore employed.

The construction of my apparatus is further explained by reference to the accompanying drawings, in which—

Figure 1 represents a side view with parts broken away to show the interior. Fig. 2 represents an end view of the ore receptacle or cylinder and its supporting mechanism, in which cylinder the ore is treated. Fig. 3 is a detail showing a cross-section of the steam-distributing pipe located in the combustion-chamber of the furnace. Fig. 4 is a sectional plan view on line Y Y of Fig. 1, and Fig. 5 is a side view of the distributing-pipe shown in Fig. 3.

Like parts are referred to by the same reference-letters throughout the several views.

A represents the rotary cylinder in which the refractory ore is simultaneously roasted and oxidized.

B is the steam-boiler, and C is the boiler-furnace or combustion-chamber, from which boiler and furnace the roasting-cylinder A is simultaneously supplied with heat and steam. The cylinder A has a free longitudinal passage between its contracted inlet and outlet ends *a* and *b*, through which passage, when the cylinder is interposed between the furnace C and the chimney D, the unconsumed smoke and products of combustion escape from the furnace to the chimney.

The rotary cylinder A is supported in the desired position, as indicated, between the boiler and the chimney upon rollers E. The rollers E are in turn supported from a substantial foundation through the shafts F and the journal-bearings G in the ordinary manner.

A slow rotary motion is communicated to the cylinder A from a motive power through the driving-belt H, pulley I, shaft J, worm-bearing K, worm-gear L, shaft F, and rollers E, connected with said shaft.

The ore is supplied to the roasting-cylinder A through one of the manholes A' and discharged from the other. The manholes are closed in the ordinary manner. Steam is conducted from the boiler B to the combustion-chamber of the furnace through the steam-pipe O, steam-controlling valve P, and distributing-pipe Q. The distributing-pipe Q is provided with a series of slots or fine perforations Q', by which the steam is uniformly distributed over the entire surface of the burning fuel, whereby the draft of the furnace is accelerated, the steam decomposed by the union of its oxygen with the carbon from the gases of the furnace, and the heating efficiency of the furnace is greatly increased, while the heat and ignited gases thus generated pass forward, as indicated, into the rotary cylinder, and the ore therein is heated to a high degree of temperature as it is simultaneously turned over and mixed by the rotation of said cylinder. To accelerate the oxidation of the ore as it is thus heated by the burning gases from the combustion-chamber, steam which has been thus superheated to a high temperature is conducted to and discharged within the rotating ore-cylinder, passing through the steam-pipe R, valve S, and heating-coil T.

The heating-coil T is preferably extended backward and forward over the burning fuel in the combustion-chamber and from thence into the rotary roasting-cylinder, above the ore therein, as shown in Fig. 1, whereby it is obvious that the steam is exposed to a high temperature. A part of the gas thus produced by bringing the superheated steam and gases from the furnace together is taken up by the heated ore, whereby the same is oxidized and converted into free-milling ore.



It will be obvious that the quantity of steam admitted through the respective pipes O and R may be governed at will by the operator by the steam-controlling valves P and S. When  
 5 the ore has been thus roasted and oxidized for from one to two hours, the time varying more or less according to the quality or nature of the ores treated, the heat and steam may be cut off and the ore removed.

10 To accelerate the action of the heat and gases upon the ores as they are treated, the discharge end B of the rotary ore-cylinder is preferably contracted as indicated. It will be obvious that by rotating the cylinder as  
 15 heat and gases are thus admitted the ore will be carried up on one side of said cylinder, turned over and agitated and thoroughly mixed, whereby the heat and oxidizing gas are brought in contact with and caused to act  
 20 upon the entire contents of the cylinder, whereby the same is uniformly heated and oxidized.

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

1. In an apparatus for simultaneously roasting and oxidizing refractory ores, the combination of a rotary ore-retaining cylinder having contracted inlet and outlet end openings  
 30 for the admission and escape of heat or other products of combustion, adapted to retain the ore while being roasted; means for supporting and rotating said cylinder; a furnace; a steam boiler or generator located over said  
 35 furnace, said furnace being adapted to supply heat both to said boiler and said rotary ore-cylinder; a superheating steam-coil located in said furnace; and a steam-pipe communicating from said boiler to said superheating  
 40 steam-coil, and from thence to the ore-retaining cylinder, all substantially as and for the purpose specified.

2. In an apparatus for simultaneously roasting and oxidizing refractory ores, the combination of a rotary ore-retaining cylinder having contracted inlet and outlet openings for the passage of heat and products of combustion; two pairs of cylinder-supporting roller-bearings, each pair respectively being located

beneath and upon the respective sides of the  
 longitudinal axis of said cylinder, and connected together by a supporting-shaft; a driving-gear connected with the shaft of one of  
 said pairs of roller-bearings; means for communicating motion to said driving-gear; a  
 55 furnace; a steam boiler or generator located over said furnace, said furnace being adapted to supply heat to both said boiler and said ore-cylinder; a steam-pipe communicating from said boiler to a superheating steam-coil  
 60 in said furnace, and from thence into the rotary ore-cylinder, and a second steam-pipe communicating from said boiler to a distributing-pipe within said furnace, both of which steam-pipes are provided with a steam-con-  
 65 trolling valve, all substantially as and for the purpose specified.

3. In an apparatus for simultaneously roasting and oxidizing refractory ores, the combination of a rotary ore-retaining cylinder provided with a man hole or holes through which  
 70 the same is filled and emptied; two pairs of cylinder-supporting roller-bearings, each pair respectively being located beneath and upon the respective sides of the longitudinal axis  
 75 of said cylinder and connected together by a supporting-shaft; a driving-gear connected with the shaft of one of said pairs of roller-bearings; means for communicating motion to said driving-gear; a draft flue or chimney;  
 80 a furnace communicating through the interior of said rotary cylinder to said chimney; a steam-generator located above said furnace; a steam-pipe communicating from the boiler through a steam-coil located in the furnace,  
 85 and from thence into said rotary ore-cylinder; and a second steam-pipe also communicating from said boiler to a distributing-pipe provided with slots or perforations within the said furnace, all substantially as and for the  
 90 purpose specified.

In testimony whereof I affix my signature in the presence of two witnesses.

ROBERT A. STEWART.

Witnesses:

JAS. B. ERWIN,  
 C. L. ROESCH.