995,979.

S. McCLOUD.

AUTOMATIC BUSHELING FURNACE.

APPLICATION FILED SEPT. 28, 1907.

Patented June 20, 1911.

5 SHEETS—SHEET 1.

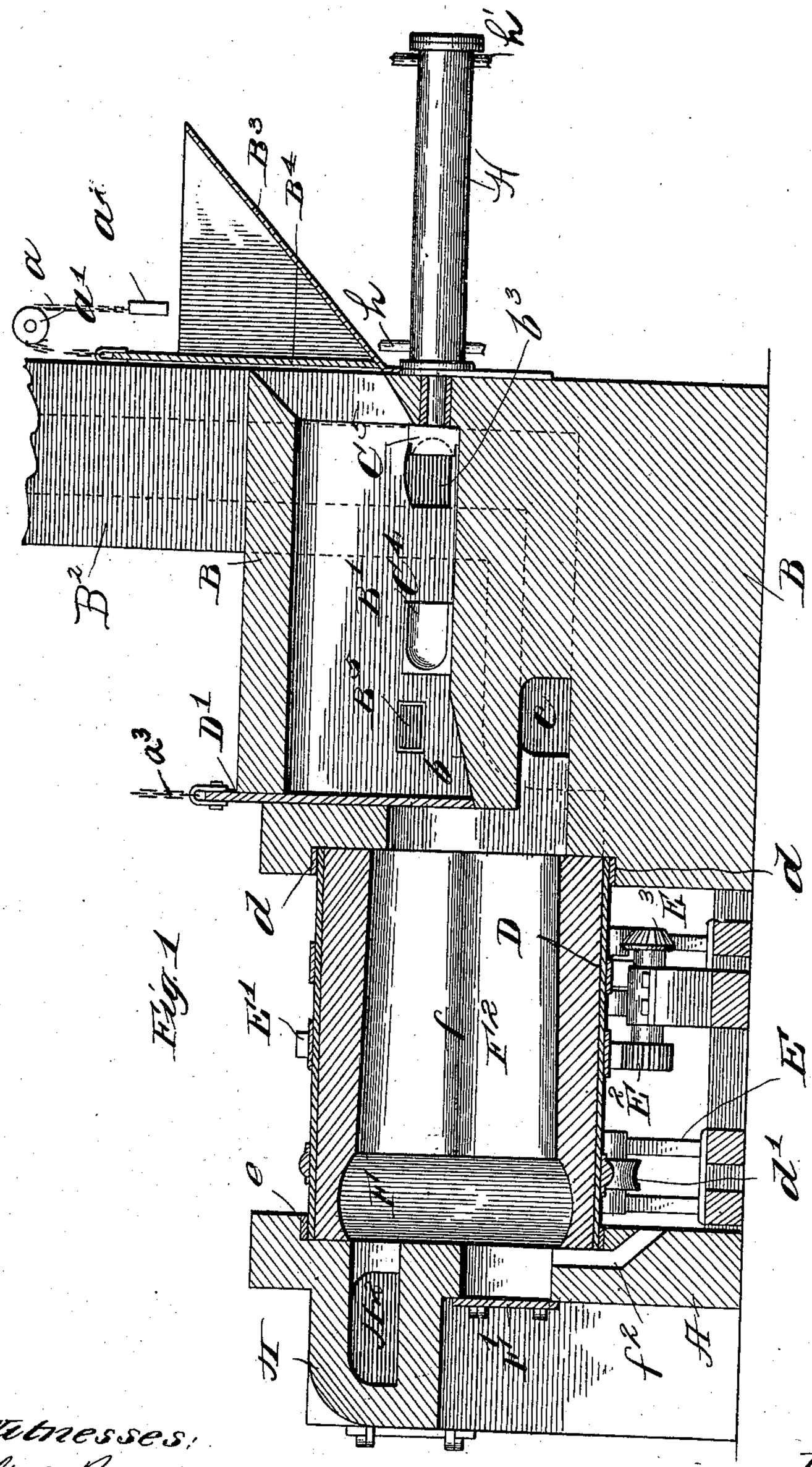

Fig. 1.

Witnesses:

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5 SHEETS—SHEET 2.

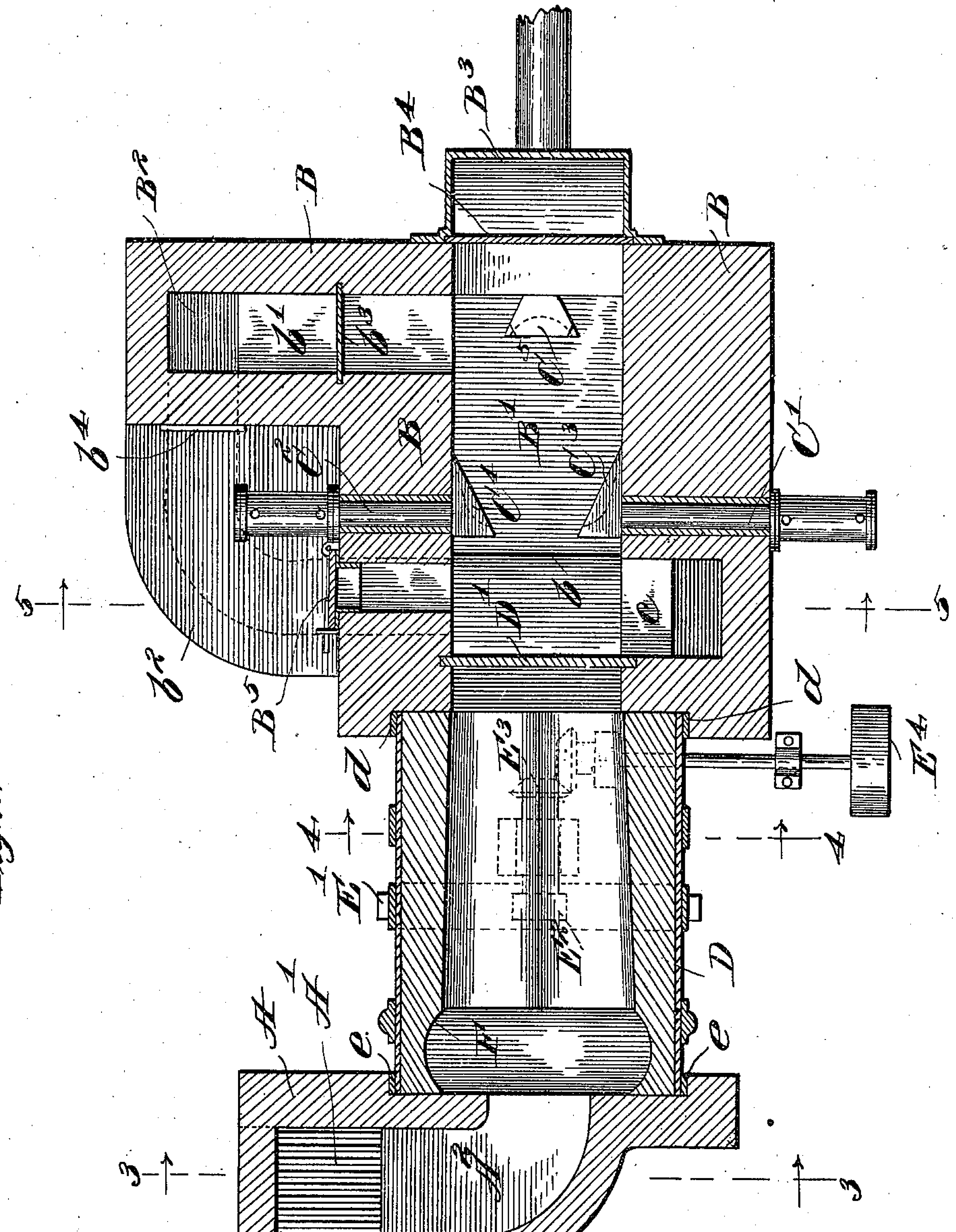

Fig. 2.

Witnesses:
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5 SHEETS—SHEET 3.

Fig. 3.

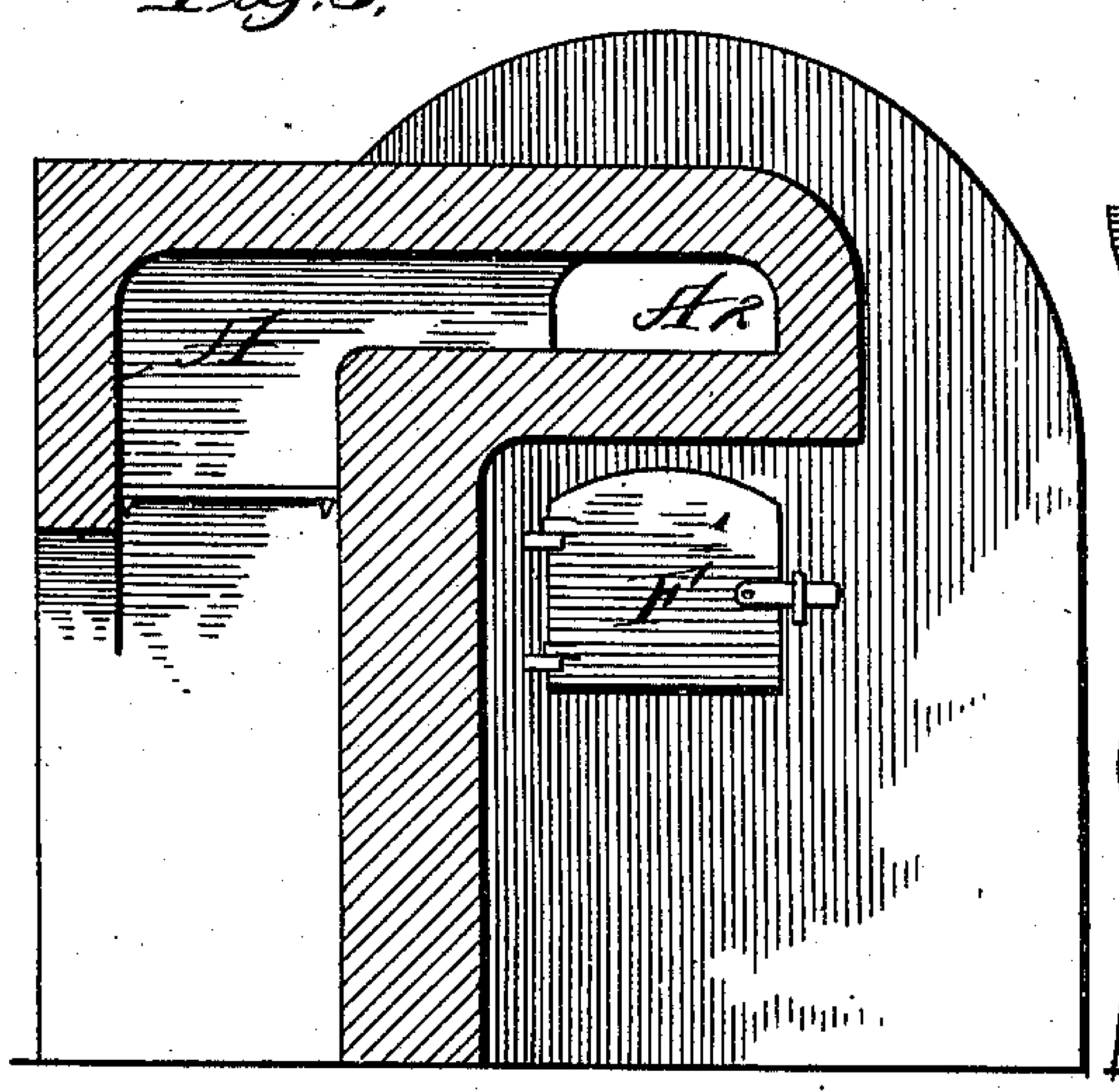


Fig. 4.

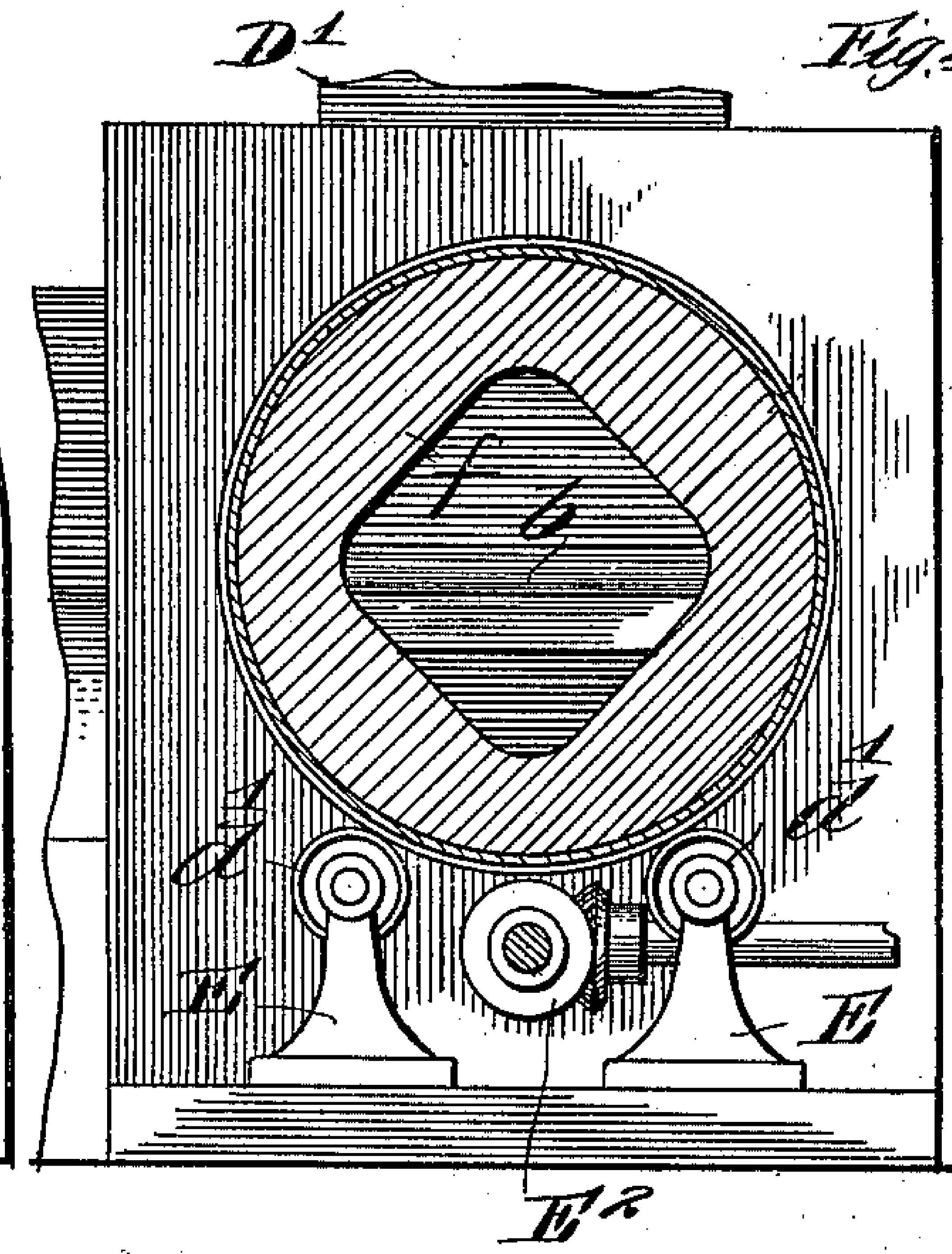
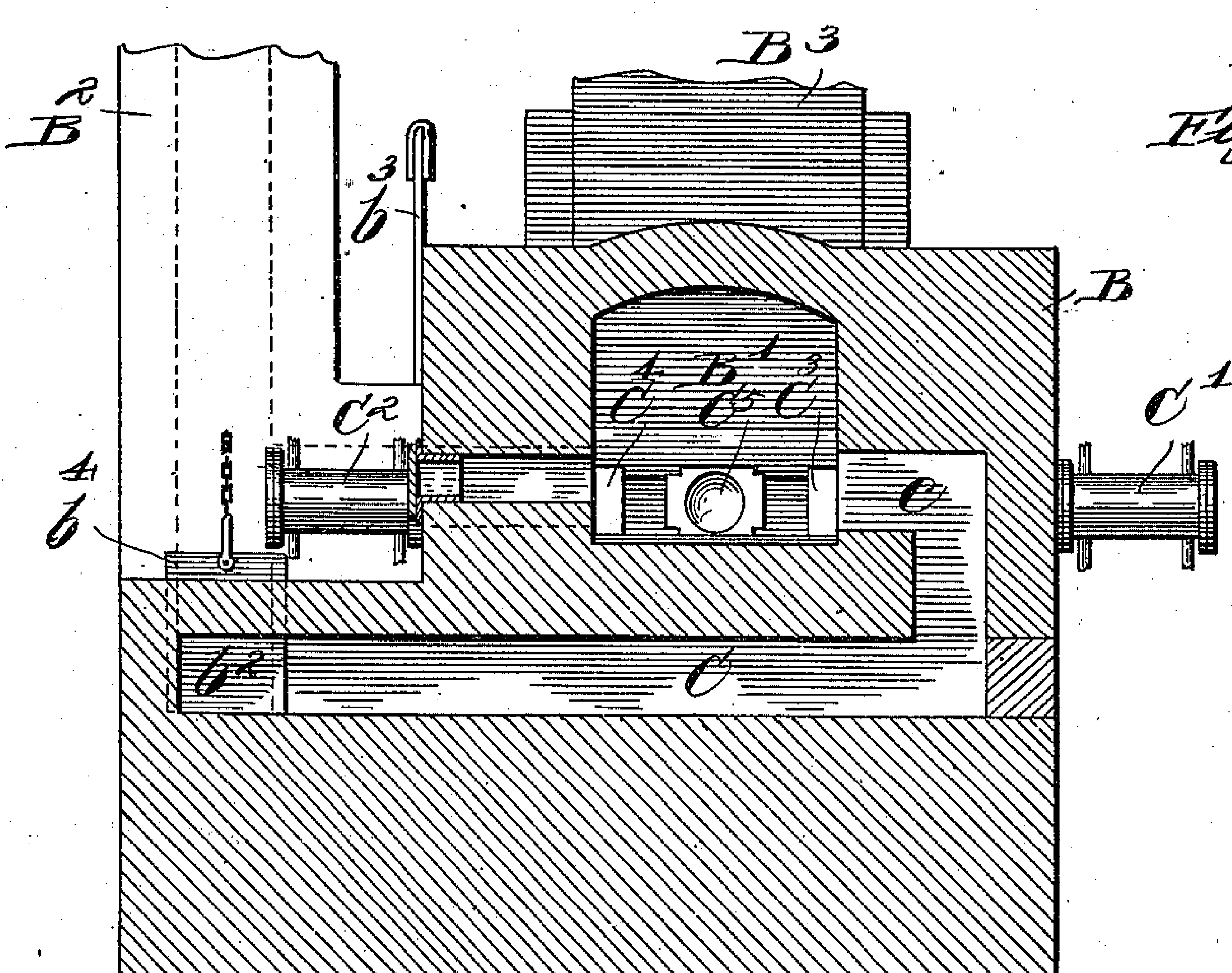


Fig. 5.



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995,979. Patented June 20, 1911.

5 SHEETS—SHEET 4.

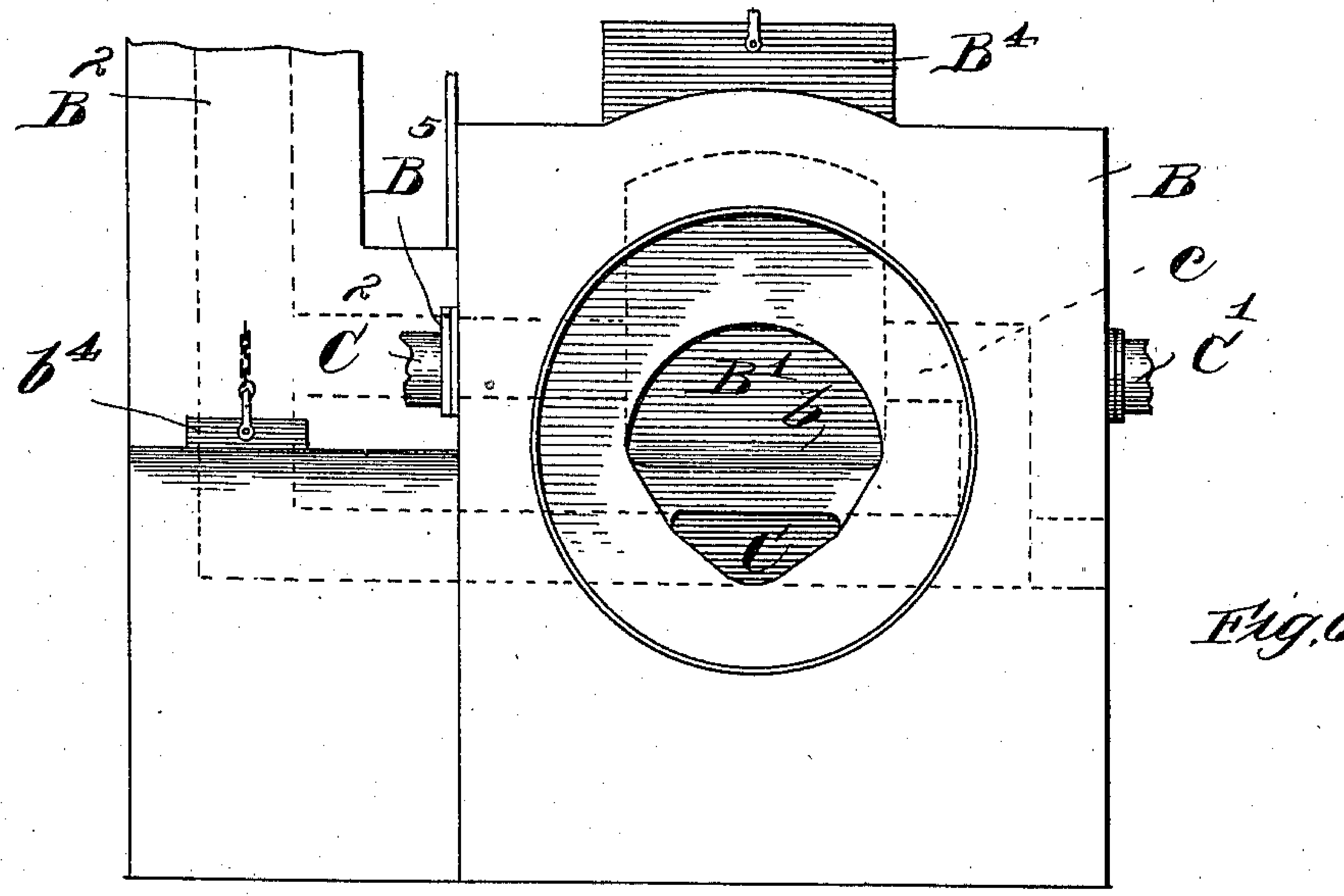
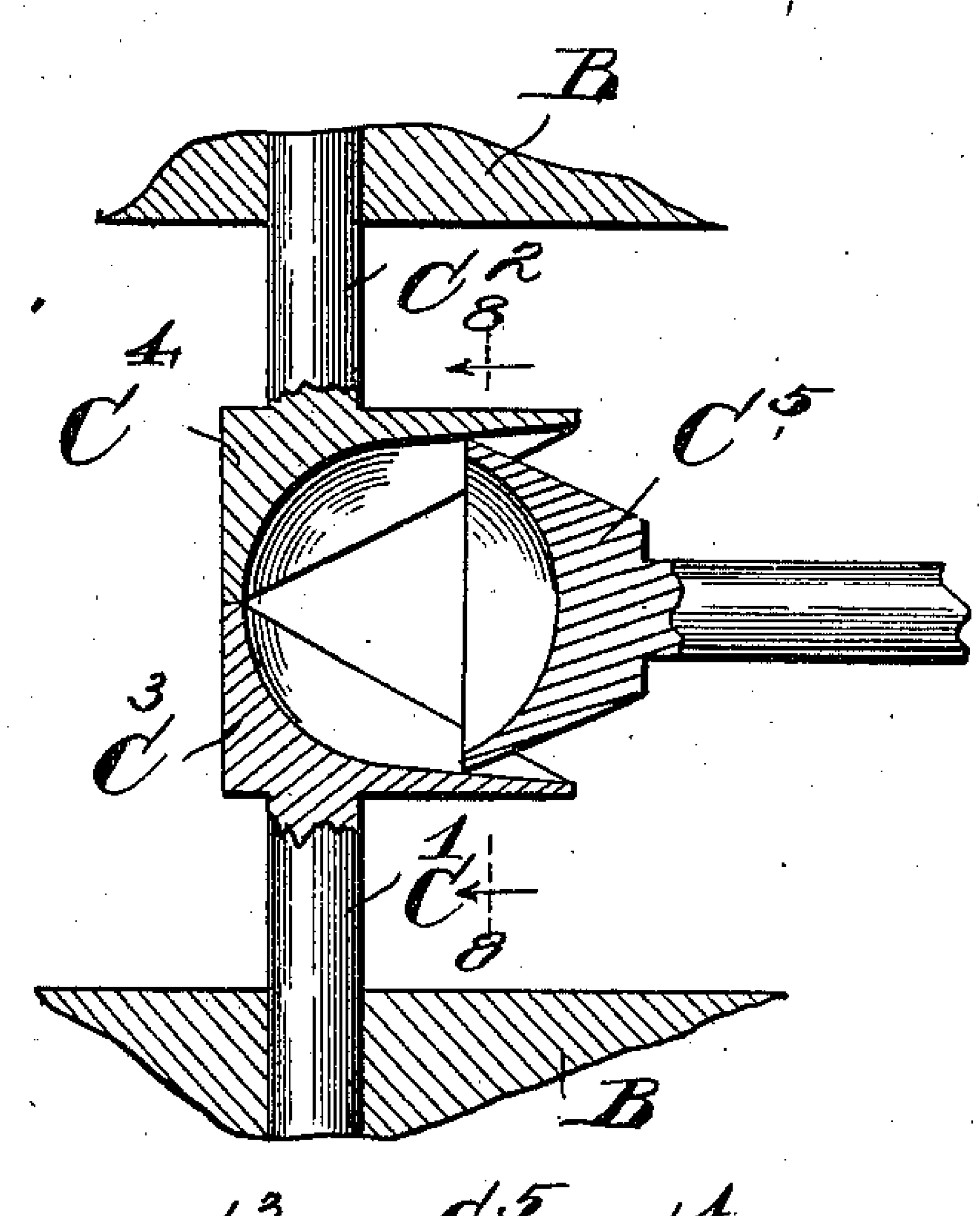


Fig. 6.

Fig. 7.



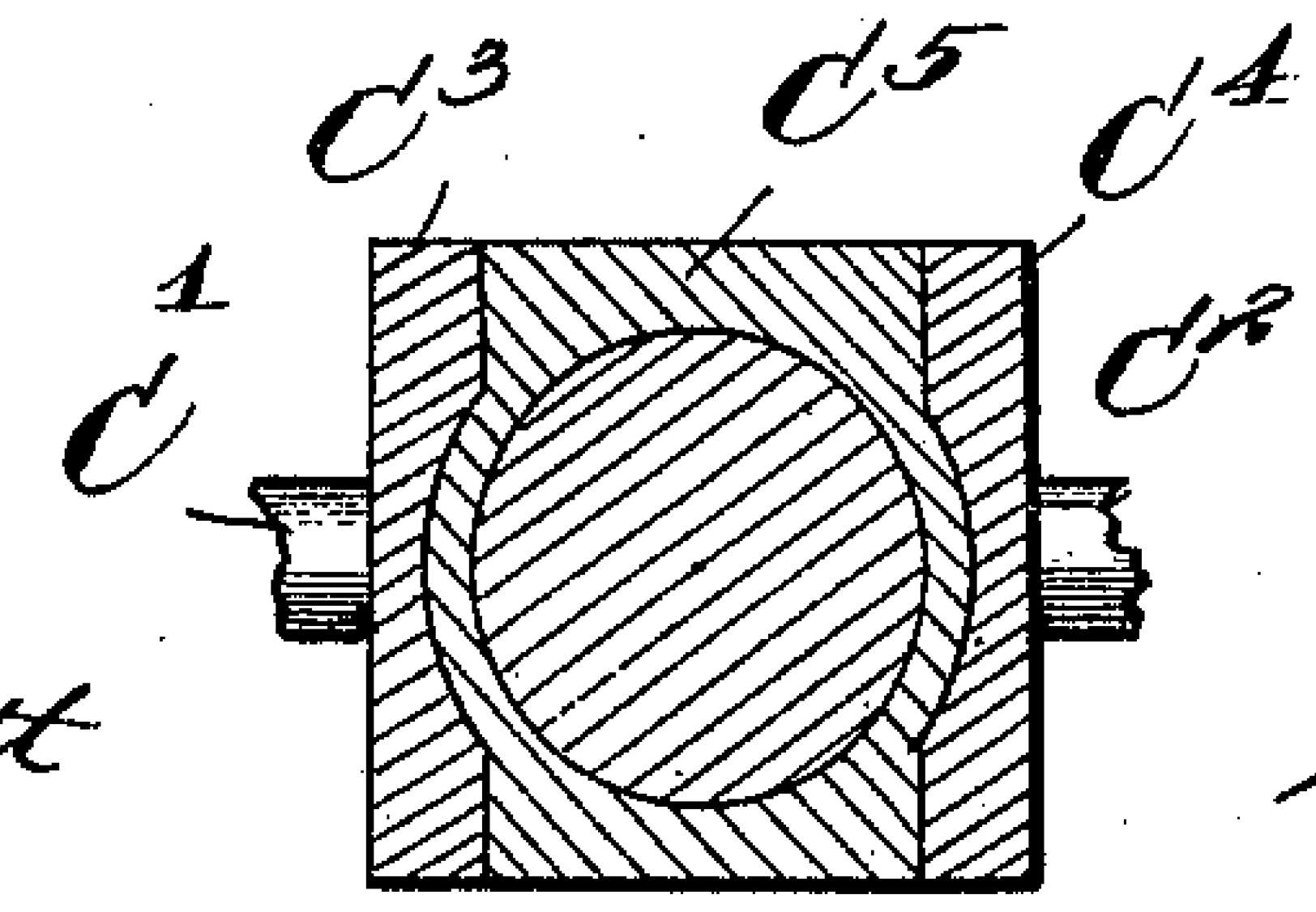


Fig. 8.

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AUTOMATIC BUSHELING FURNACE.

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995,979.

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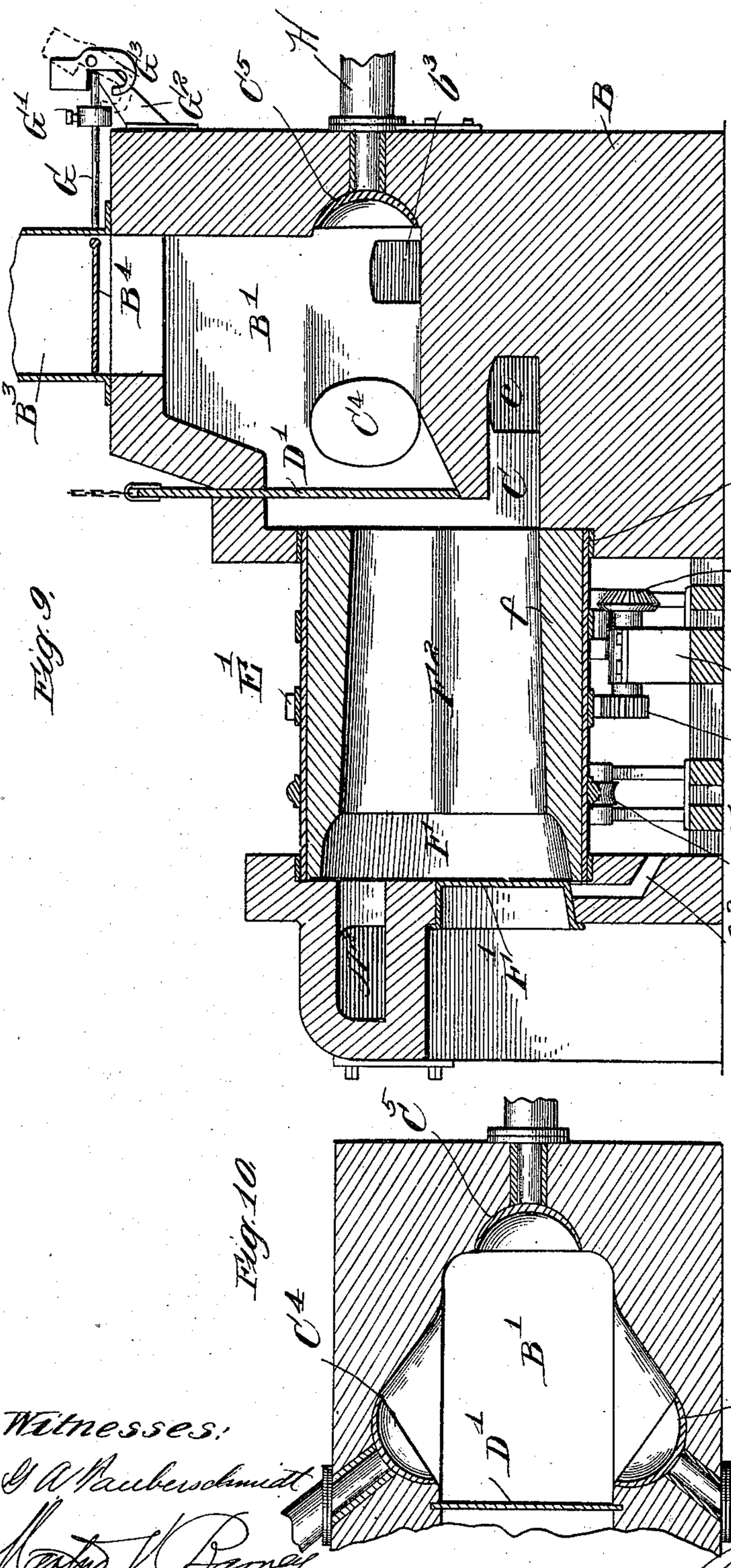
5 SHEETS—SHEET 5.



UNITED STATES PATENT OFFICE.

SIDNEY McCLOUD, OF CHICAGO, ILLINOIS.

AUTOMATIC BUSHELING-FURNACE.

995,979. Specification of Letters Patent. Patented June 20, 1911.

Application filed September 28, 1907. Serial No. 395,028.

To all whom it may concern:

Be it known that I, SIDNEY McCLOUD, a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Automatic Busheling-Furnaces, of which the following, taken in connection with the drawings, is a description.

My invention has for its object the production of an automatic busheling or scrapping furnace for metals, and is designed more particularly to be used for busheling scrap iron.

One of the objects of my invention is to secure economy of heat and fuel by reason of which the work is done in much less time, and the heat is always under perfect control.

A further object of my invention is to provide a furnace having a revoluble cylinder so constructed that there are no doors in the lateral walls of the cylinder, the metal being fed therein at one end of the cylinder and discharged at the other, while the cylinder is revolving, thereby not only saving time, but preventing the heat confined therein from having a chance to escape as in the furnaces now employed for this purpose, in which the doors are opened to allow the material to be removed from the cylinder.

Another economy secured by my furnace is that the scrap metal is charged directly into an auxiliary or supplemental furnace chamber, which utilizes the waste heat from the combustion chamber through the cylinder to soften the metal, and in which, by means hereinafter described, the material is formed into a ball and discharged into the revolving cylinder, where it is subjected to still greater heat, and from which cylinder it is finally automatically discharged to be taken to the squeezers.

The greatest advantage in the use of my invention lies in the fact that it is continuous and practically automatic throughout the entire operation, and no time is lost between the time the furnace is charged and the material is removed therefrom, and as soon as the material is passed from one stage to the next, another supply is being fed into the furnace and being operated upon at the same time. By utilizing all of the heat in the furnace and keeping it constantly in operation, the capacity of the furnace is greatly increased over the furnaces now being used in this work.

A further object of my invention is the provision of the auxiliary or supplemental furnace chamber into which the waste heat and gases from the cylinder are discharged and used over again. This auxiliary furnace chamber is so constructed that the scrap iron is fed therein as it is received, thereby obviating the necessity of shearing as is now the case in utilizing scrap iron in busheling furnaces as at present constructed. This does away entirely with a large force of help now employed to shear the scrap before it is charged into the furnace.

Other novel features of construction and operation will be hereinafter referred to in connection with the description of the working parts, and will be pointed out in the claims.

In the accompanying drawings forming part of this specification and in which like letters of reference indicate corresponding parts I have illustrated a busheling furnace embodying the preferred form of my invention, although the same may be carried into effect in other ways without in the least departing from the spirit thereof, and in these drawings: Figure 1 is a vertical longitudinal section of my invention; Fig. 2 is a longitudinal horizontal section of the same; Fig. 3 is a transverse view taken on line 3—3 of Fig. 2; Fig. 4 is a view taken on line 4—4 of Fig. 2; Fig. 5 is a view taken on line 5—5 of Fig. 2; Fig. 6 is an end view of the auxiliary or supplemental furnace with the cylinder removed; Fig. 7 is a fragmentary view of the heating chamber, illustrating the action of the plungers in forming the ball; Fig. 8 is a cross section taken through the plungers in closed position with a ball of material formed therein; Fig. 9 is a vertical longitudinal section of a modified form of my invention; Fig. 10 is an enlarged detail of the preliminary heating chamber showing the side plungers in an angular position; Fig. 11 is an enlarged detail of the rear plunger, and Fig. 12 is a cross section on line 12—12 of Fig. 11.

In carrying out my invention I employ a furnace A which may be of any well known type having the grate bars A′ and combustion chamber and flue A^2. This part of the construction being old no detailed description thereof will be given.

B are the walls of an auxiliary or supplemental furnace chamber B′ into which the waste heat and gases from the busheling

cylinder D pass wherein they are utilized in heating the material before it is passed into the cylinder and reducing it to a state sufficiently viscid or tenacious to form a ball. The chamber B′ extends longitudinally in line with the busheling cylinder, and is provided with a floor *b* of brick or other suitable material, which is inclined at one end thereof toward the revoluble busheling cylinder D. The opening from the end of the auxiliary chamber B′ into the revoluble cylinder D is closed by a vertically movable door D′ which can be adjusted to any desired position by means of a chain a^3 extending from said door. When the furnace is first started this door is left open to create a strong draft, and after a high degree of heat is obtained in the chamber B′ the partial closing of the door will prevent large quantities of heated gases from escaping into the stack where the heat would be dissipated and lost.

B^2 is the stack and communicating therewith are the flues *b′* directly from the auxiliary chamber and b^2 indirectly from the rear of said chamber, (see Fig. 2) said flues being controlled by the dampers b^3 and b^4 respectively. B^3 is a hopper, which may be arranged on the end, side or top of the auxiliary furnace, through which the furnace is charged. A door B^4 controls the entrance from the hopper to the chamber B′. This door may be adjusted to any desired position by means of a chain *a* extending from the door over a fixed pulley *a′*, and having a counterbalance weight a^2 at the other end, or by any other suitable means.

A flue C communicating with the revoluble cylinder D and extending beneath the floor *b* of the auxiliary furnace, reaches transversely of the same, and upon one side thereof communicates with the interior of the furnace, as at *c*, (Fig. 5), and upon the other side with flue b^2 leading to the stack. The direction of the passage of the heat and gases through the flue is regulated by the dampers b^3 and b^4. If it is desired to have the heated gases pass through the chamber B′ the damper b^3 is opened, when the draft therethrough will carry it through the heating chamber B′, but when the heat is too intense the damper b^3 is closed and b^4 is opened which will carry the heat and gases through the flue b^2 directly to the stack. A sight door B^5 is provided in the rear wall of the auxiliary furnace through which the interior of the chamber B′ or the charge therein may be inspected at any time.

Extending through the side walls of the auxiliary furnace are the piston rods C′, C^2 carrying upon the end thereof the plungers C^3, C^4 which are made of refractory material. These plungers are hollow and beveled rearwardly on the edges thereof, as shown in Fig. 2. These plungers are operated by hydraulic or any other pressure suitable for the purpose. Coöperating therewith is the plunger C^5 extending through the end wall of the auxiliary furnace B and which may be driven by hydraulic or other suitable motive power. The operation of these plungers will be hereinafter described.

In the wall of the inner end of the auxiliary furnace chamber, beyond the plungers is a circumferential recess *d* inside of which rests one end of the revoluble cylinder D. This cylinder rests and revolves upon antifriction rollers *d′* which are mounted in suitable bearings supported by the standards E, E. Extending around the circumference of the cylinder D and secured thereto, is a gear E′ which meshes with the gear wheel E^2, to which motion is transmitted through the beveled gears E^3 driven by the pulley E^4 which is connected with any suitable source of power.

In the wall at one end of the cylinder is a circumferential recess F, and extending from said recess through the interior of the cylinder is a lining of refractory material *f* so arranged that the longitudinal walls of the interior of the cylinder are at angles to each other, for example, practically at right angles as shown in Fig. 4 forming a four sided passage F^2, which, however, flares slightly from the end of the cylinder opening into the auxiliary furnace toward the recess F so that as the cylinder is being revolved with the material delivered to it over the sloping floor *b* said material will gravitate toward the recess F. The cylinder may be mounted in an inclined plane and accomplish the same result as building an inclined lining. The angular sectional outline of the passageway will cause the balled material to be carried up by the revolution and then fall back with a hammering action.

The wall A of the grate A′ is extended laterally, or at right angles to form a support for one end of the cylinder D. This wall has a circumferential recess *e* therein, into which the outer end of the cylinder D is supported and revolves. A door F′ is provided in the wall A, which opens to the discharge end of the revoluble cylinder and through which the material is removed; the furnace grate A being by the above construction brought to one side of this door permitting it to be in line with the cylinder. An opening f^2 extends through the wall A beneath the door F′ through which the cinders passing through the cylinder are discharged and carried out of the way.

In Fig. 9 I have illustrated a furnace embodying some modified details of construction which I contemplate in carrying out my invention. In this instance the hopper B^3 is placed on top of the heating chamber B′ and is provided with an automatic arrangement for dumping the charge into the

furnace. The door B^4 is hinged to the wall of the hopper B^3, and a rod G is rigidly secured to the said door. A weight G′ is movable thereon and may be adjusted to dump the load at the number of pounds desired. A brace G^2 extends upwardly from the wall B and has pivotally secured thereto the hook G^3. When a load of sufficient weight is placed upon the door it will automatically drop into the furnace chamber. This movement of the door B^4 has thrown the rod G upwardly until the hook G^3 moves to the position shown in dotted lines. As soon as the load has been dumped the weight G′ will bear against the hook and restore it to normal position together with the door B^4, which will then be ready to receive the next load.

In Fig. 11 I have illustrated the water jacket H which is designed to keep the plunger C^5 cool. The plunger itself is hollow and has a hollow driving rod C^6 with a partition c^6 therein. A piston H′ operates in the jacket C^6 to drive the plunger C^5. This piston is driven by any suitable means attached to the rod H^2. h is an inlet pipe communicating with the interior of said jacket, h' is the exhaust. If desired the plungers C^3, C^4 may be cooled in the same way. In this modified form of construction the plungers C^3, C^4 are disposed at acute angles to the center of the chamber as shown in Fig. 10. The recess F is flared to the discharge end of the cylinder, permitting the ball to pass through the cylinder and drop against the discharge door F′. The attendant then simply opens the door F′ and the ball will be discharged therethrough by gravity.

The operation of the furnace is as follows: A fire is started in the grate A and the door D′ is left open. The flame, with the heated gases, pass through the flue A^2 into the revoluble cylinder D and through the open door D′ into the chamber B of the auxiliary furnace. When a sufficiently high degree of heat is reached, the door D′ is closed or partially closed and the auxiliary furnace chamber is charged through the hopper B^3. When the material in this chamber is heated and sufficiently viscid or tenacious, the plungers C^3, C^4 and C^5 are set in operation, gathering and ramming it into a ball, which the plunger C^5 with a final movement, while the others are withdrawn, will move to the edge of the incline b, when the door D′ is raised sufficiently to allow it to drop by gravity down the incline into the revoluble furnace where it is kept heated and agitated by the revolving of the cylinder D which further compacts the material and welds it together into a ball while it gradually passes over the inclined surface of the interior of the cylinder, finally dropping into the trough of the recess F when it is ready to be removed by an attendant and carried to the rolls. By the time the first ball has reached the door F′, another ball has entered the cylinder at the opposite end thereof, another one has just been formed by the plungers C^3, C^4 and C^5 and passed to the incline b and a new charge has been placed in the chamber ready to be heated, and by this it will be seen that I have provided a furnace which is continuous and automatic in its operation, and one which can be operated without continuously opening the doors of the furnace and allowing a large percentage of the heat to be lost during the running.

By means of dampers b^3 and b^4 the heat is at all times under complete control. When it is desired to allow the heat to pass through the cylinder and directly into the auxiliary furnace chamber, the door D′ is left open to pass all of the waste heat from the cylinder into the auxiliary furnace chamber. If less heat is desired this door is closed and the flame will pass through the flues C, c into the chamber, and the damper b^3 being open the waste heat will pass therethrough to the stack. If less heat is desired in the chamber B′ the damper b^3 is closed and b^4 opened, when the heat and the gases will pass through the flue C directly to the stack.

In utilizing my invention it will be obvious that the cylinder may be removed entirely if desired and the heating and welding of the material may be done in the chamber B′, and the ball discharged through the door D′ and taken to the rolls. I have illustrated in the drawings a grate adapted to the use of coal as fuel, but I desire to be understood as contemplating the use of any fuel suitable for the purpose. I contemplate also any other changes in the details of my invention coming within the scope thereof.

I claim:

1. Metal busheling apparatus comprising a furnace, a revoluble cylinder, an auxiliary furnace chamber giving a preliminary heating to the metal, means for compressing the heated metal and discharging it from the furnace to the cylinder.

2. Metal busheling apparatus comprising a revoluble cylinder, an auxiliary furnace chamber for initially heating the scrap metal communicating with said cylinder, a vertically movable door between said cylinder and furnace, and means for heating said cylinder and chamber.

3. In a metal busheling apparatus the combination of a revoluble cylinder, an auxiliary furnace chamber having communication with one end of said cylinder, a discharge door opening at the other end of the cylinder, and a fire grate disposed at right angles to the cylinder to expose the door, substantially as described.

4. In busheling apparatus, the combination of a revoluble cylinder, a furnace grate disposed at right angles to said cylinder and

having a flue communicating with one end thereof, an auxiliary furnace chamber having communication with the other end of said cylinder, and means for compressing and balling the heated metal in said chamber and passing it into the revoluble cylinder.

5. In busheling apparatus the combination of a revoluble busheling cylinder, an auxiliary furnace chamber communicating with one end of the cylinder, a furnace grate and combustion chamber communicating with the other end of said cylinder, and a lining in said cylinder arranged to form a square or angular passage therethrough.

6. In a busheling apparatus, the combination of a revoluble busheling cylinder and an auxiliary furnace chamber communicating with one end of said cylinder, a furnace grate and combustion chamber communicating with the other end of said cylinder, a lining forming a transversely polygonal wall in said cylinder, said cylinder having a circumferential recess in the wall of one end thereof, substantially as described.

7. In a busheling apparatus, the combination with a preliminary heating chamber and a busheling cylinder, one end of which opens into said chamber to receive the heated material therefrom, the inner wall of said cylinder being polygonal in transverse section and having a circumferential recess at the discharge end thereof, substantially as described.

8. In busheling apparatus, the combination with an auxiliary furnace for imparting a welding heat to the metal, means for compressing said metal, of a busheling cylinder constructed with a welding passage flaring from its receiving end to its discharging end and means for discharging the compressed material into the busheling cylinder.

9. In a busheling apparatus, the combination with an auxiliary furnace for imparting a welding heat, of a busheling cylinder having a circular recess at its discharge end, and having a welding passage therethrough from its receiving end to the aforesaid recess, said passageway being polygonal in transverse section.

10. In busheling apparatus the combination with suitable means for imparting a welding heat, of a busheling cylinder constructed with a welding passage therethrough, the inner walls of said cylinder being polygonal in transverse section, and having a circular recess at its discharge end to receive the balls.

11. In busheling apparatus the combination with suitable means for imparting a welding heat, of a busheling cylinder having a lining of refractory material, said lining being of less thickness near the discharge end of the cylinder and rising on an incline to the thicker portion of said lining, the thicker portion of said lining being arranged to form a passage way which is polygonal in transverse section and flaring from the receiving end of said cylinder to the aforesaid incline.

12. In a busheling furnace, the combination of a revoluble busheling cylinder having a combustion passage therethrough, a furnace grate and combustion chamber delivering to one end of said cylinder, an auxiliary furnace chamber communicating with the opposite end of said cylinder and a hopper opening into the aforesaid chamber, and plungers operating through the walls of said chamber to work the heated material and deliver the same to the cylinder, substantially as described.

13. In a busheling furnace, the combination of a revoluble busheling cylinder having a combustion chamber therein, a furnace grate and combustion chamber delivering to one end of said cylinder, an auxiliary furnace chamber communicating with the opposite end of said cylinder, a hopper discharging into the aforesaid chamber, a weighted door in the bottom of said hopper, and means for automatically discharging the load from the hopper and restoring the aforesaid door to normal position, substantially as described.

14. In a busheling apparatus the combination of a revoluble busheling cylinder having a chamber therethrough, with an auxiliary furnace chamber adapted to utilize the waste heat from the cylinder and to deliver its charge to one end of the latter, a hopper communicating with said chamber, a plurality of plungers extending through the walls of said furnace and adapted to work and compress the material being heated therein, and means for applying heat to the aforesaid chambers.

15. In a busheling apparatus, the combination of a revoluble busheling cylinder, the interior wall of said cylinder being polygonal in transverse section, with an auxiliary furnace chamber adapted to utilize the waste heat from the cylinder and deliver its charge to one end of the latter, a hopper communicating with said chamber, an automatically operated door in the bottom of said hopper, plungers extending through the walls of said furnace and adapted to compress the material being heated therein, and means for supplying heat to said furnace.

16. In busheling apparatus, the combination of a revoluble busheling cylinder and a preliminary heating chamber having communication therewith, of a plurality of plungers operating through the walls of said chamber to work, compress and ball the material therein, substantially as described.

17. In a busheling apparatus, the combination of a revoluble busheling cylinder and a preliminary heating chamber having communication therewith, plungers operating

through the walls of said chamber to compress the heated material therein, and means for cooling said plungers, substantially as described.

18. In busheling apparatus, the combination of a revoluble busheling cylinder and a preliminary heating chamber having communication therewith of a plurality of plungers having cupped faces operating through the walls of said chamber to work, compress and ball the material therein.

19. In a busheling apparatus, the combination of a revoluble busheling cylinder, an auxiliary furnace chamber having communication therewith, the bottom of said chamber being inclined toward the receiving end of said cylinder, a charging opening communicating with said auxiliary furnace and plungers operating through the walls of said auxiliary furnace whereby the material is compressed and balled and moved over the inclined floor to the cylinder.

20. In a busheling apparatus, the combination of a revoluble busheling cylinder, an auxiliary furnace chamber having communication therewith, the bottom of said chamber being inclined toward the receiving end of the cylinder, a hopper discharging into said chamber, an automatically operated door in the bottom of said hopper, and plungers operating through the walls of said auxiliary furnace whereby the material is compressed and balled and moved over the inclined floor to the cylinder.

21. In a busheling apparatus, the combination of a revoluble busheling cylinder, an auxiliary furnace chamber having communication therewith, the bottom of said chamber being inclined toward the receiving end of the cylinder, a hopper discharging into said chamber, an automatically operated door in the bottom of said hopper, three plungers operating through the walls of said auxiliary furnace, one of said plungers operating in a direction at right angles to the other two, whereby the material is compressed and balled and moved over the inclined floor to the cylinder.

22. In busheling apparatus, a revoluble busheling cylinder having a circumferential recess in the wall at the discharge end thereof, and a lining for said cylinder so arranged that it presents an interior passage way having an inner wall which is polygonal in transverse section through said cylinder.

23. In a busheling furnace, the combination of a revoluble busheling cylinder, a furnace located at right angles to the discharge end of said cylinder, a preliminary heating chamber delivering to the opposite end of said cylinder, a hopper delivering to said chamber, and means for passing the charge from the chamber to the cylinder, substantially as described.

24. In a busheling apparatus, the combination of a revoluble busheling cylinder, the inner wall of said cylinder being polygonal in transverse section, a furnace located at right angles to the discharge end of said cylinder, a preliminary heating chamber delivering to the opposite end of said cylinder, and means for controlling the heat in said chamber, a hopper delivering to said chamber, means for passing the charge from the chamber to the cylinder, and a door in line with the discharge end of the cylinder, substantially as described.

25. In a busheling apparatus, the combination of a revoluble cylinder, a fire grate disposed at right angles to the cylinder and having one side wall extending to form a support for one end of said cylinder, a discharge door opening to the end of said cylinder, the wall beneath the door having an opening through which cinders are discharged, and an auxiliary furnace communicating with the opposite end of the aforesaid cylinder, substantially as described.

26. In a busheling apparatus the combination with a preliminary heating chamber, a busheling cylinder communicating with said chamber, means for compressing and balling the material in the aforesaid heating chamber and discharging it into the cylinder, a discharge door at the end of said cylinder, and means for automatically rolling said ball through the cylinder and out of the discharge door.

27. In a busheling apparatus, the combination of a furnace, the bottom of said furnace being inclined toward the discharge end thereof, means for supplying and controlling the heat in said furnace, plungers operating through the walls of said furnace to compress and ball the material therein, and means for discharging the ball from the furnace.

28. In a busheling apparatus, the combination of a furnace, a hopper discharging into the furnace chamber, a door closing the discharge end of the furnace, and plungers operating through the walls of said furnace chamber to compress and ball the material therein, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

SIDNEY McCLOUD.

Witnesses:
G. W. JOHNSTON,
MARTIN V. BARNEY.