J. THOMSON.

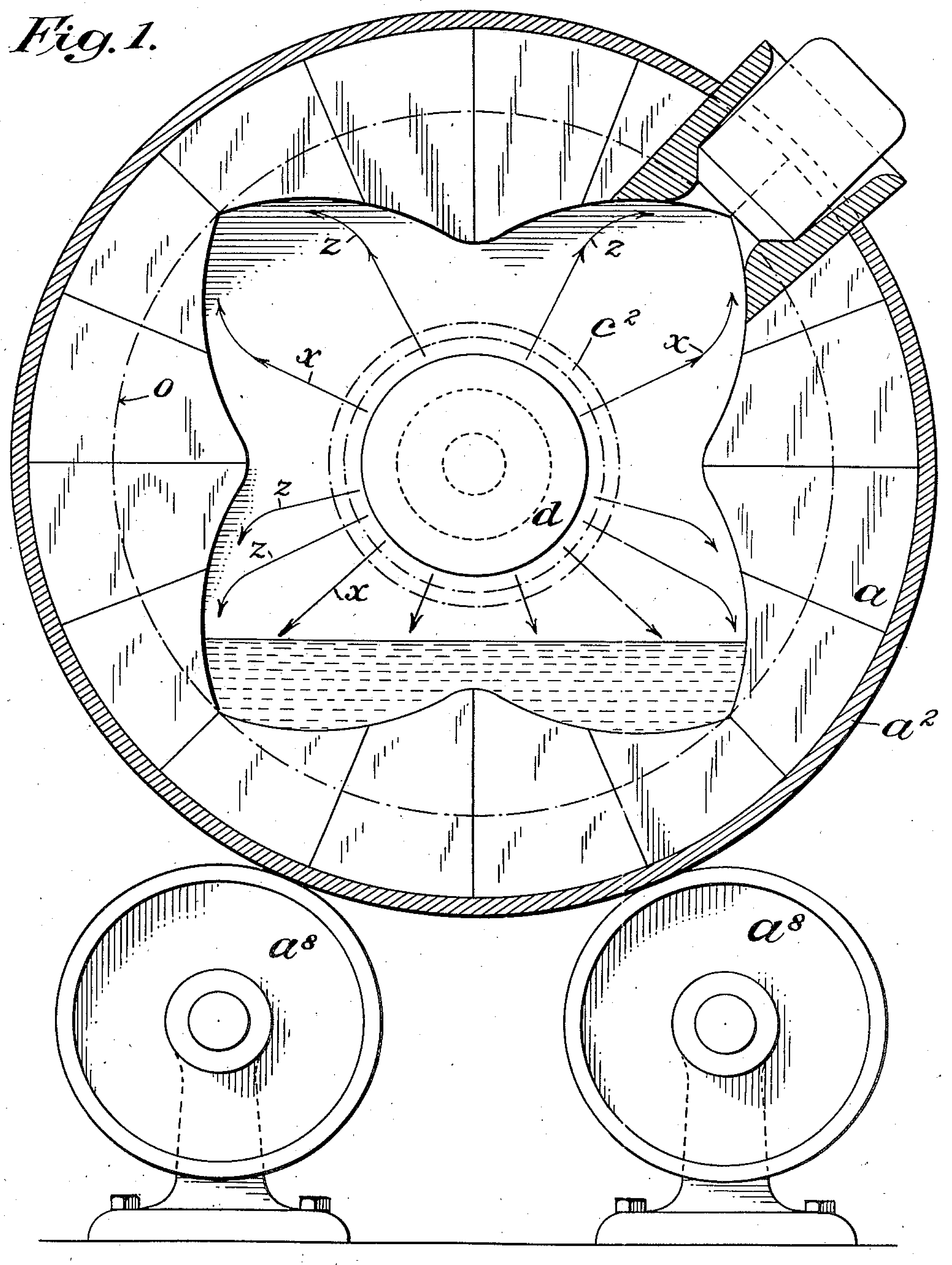
ELECTRIC FURNACE.

APPLICATION FILED SEPT. 1, 1909.

950,880. Patented Mar. 1, 1910.

4 SHEETS—SHEET 1.

Fig. 1.



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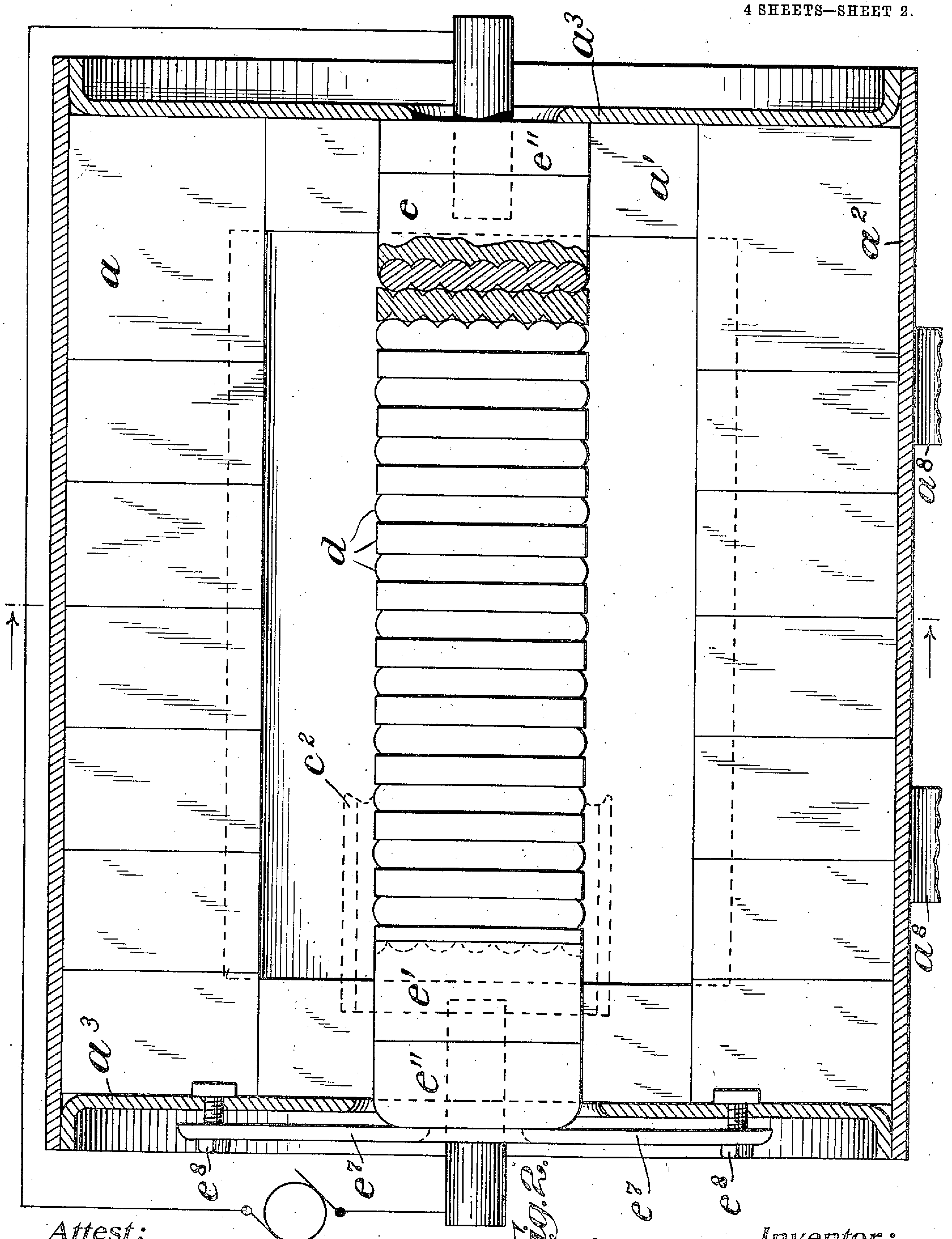
4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

Fig. 3.

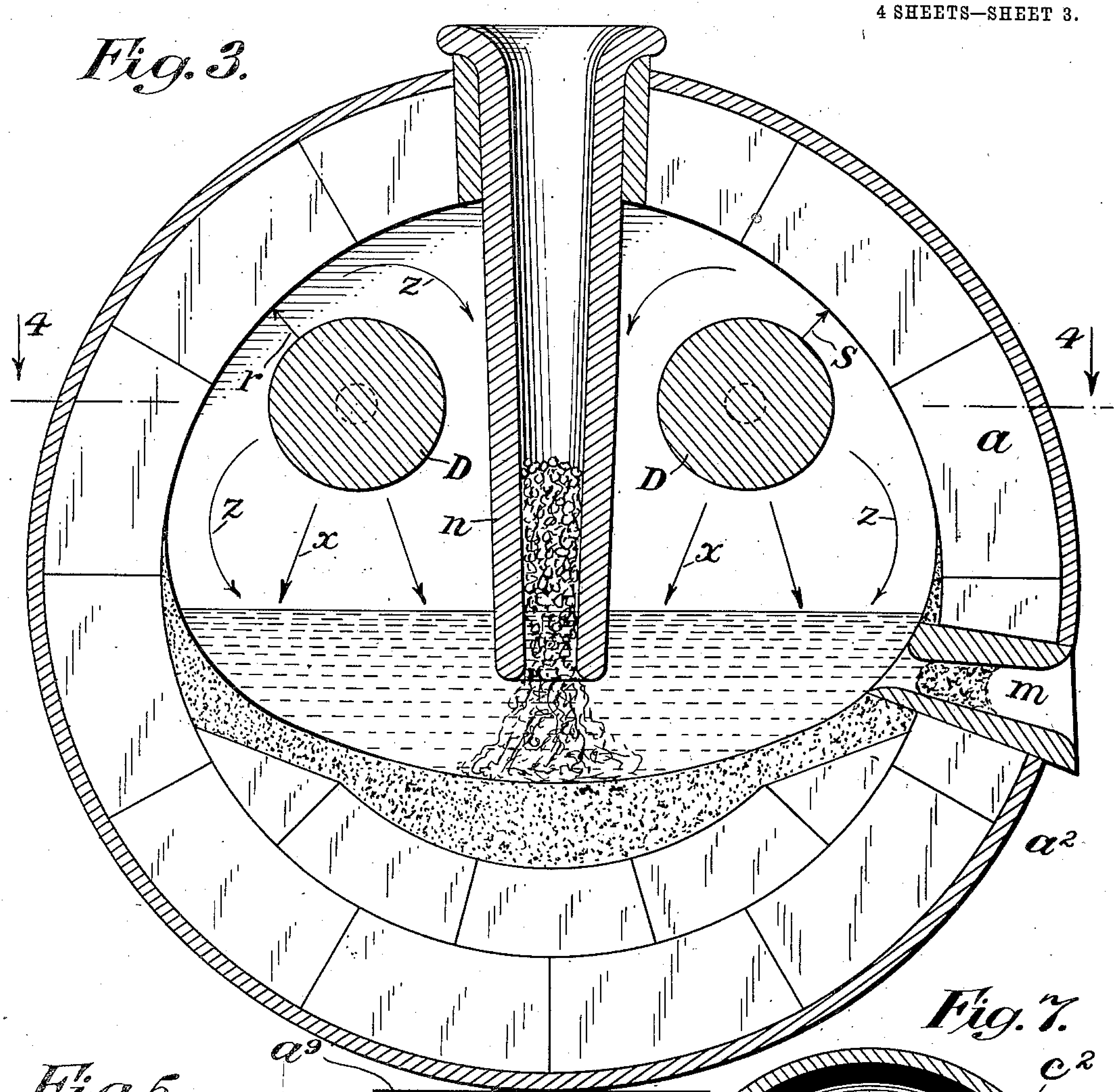


Fig. 5.

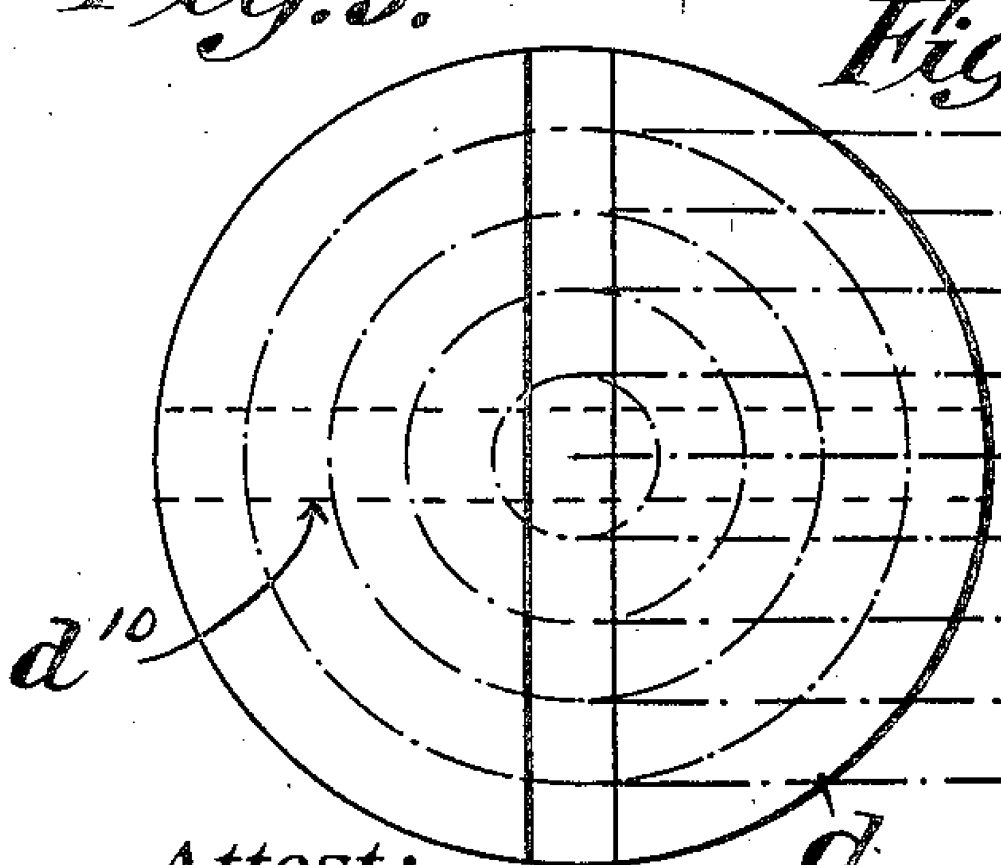


Fig. 6.

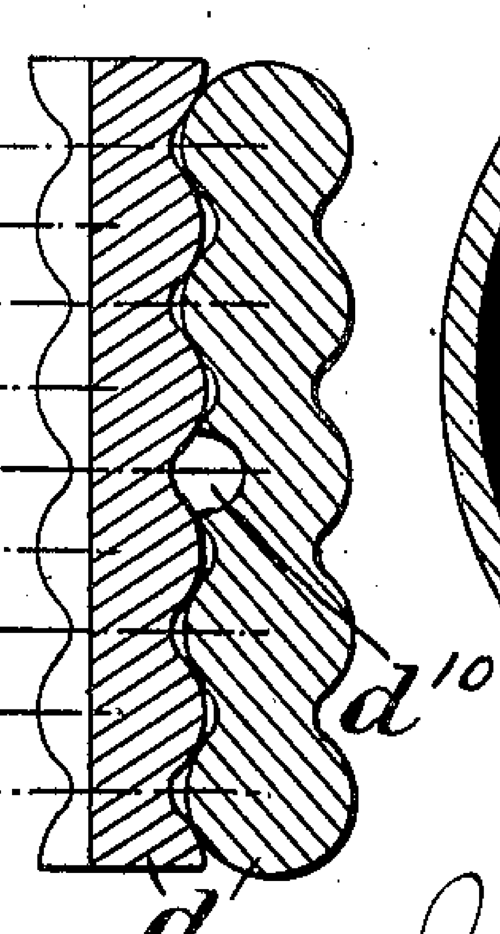
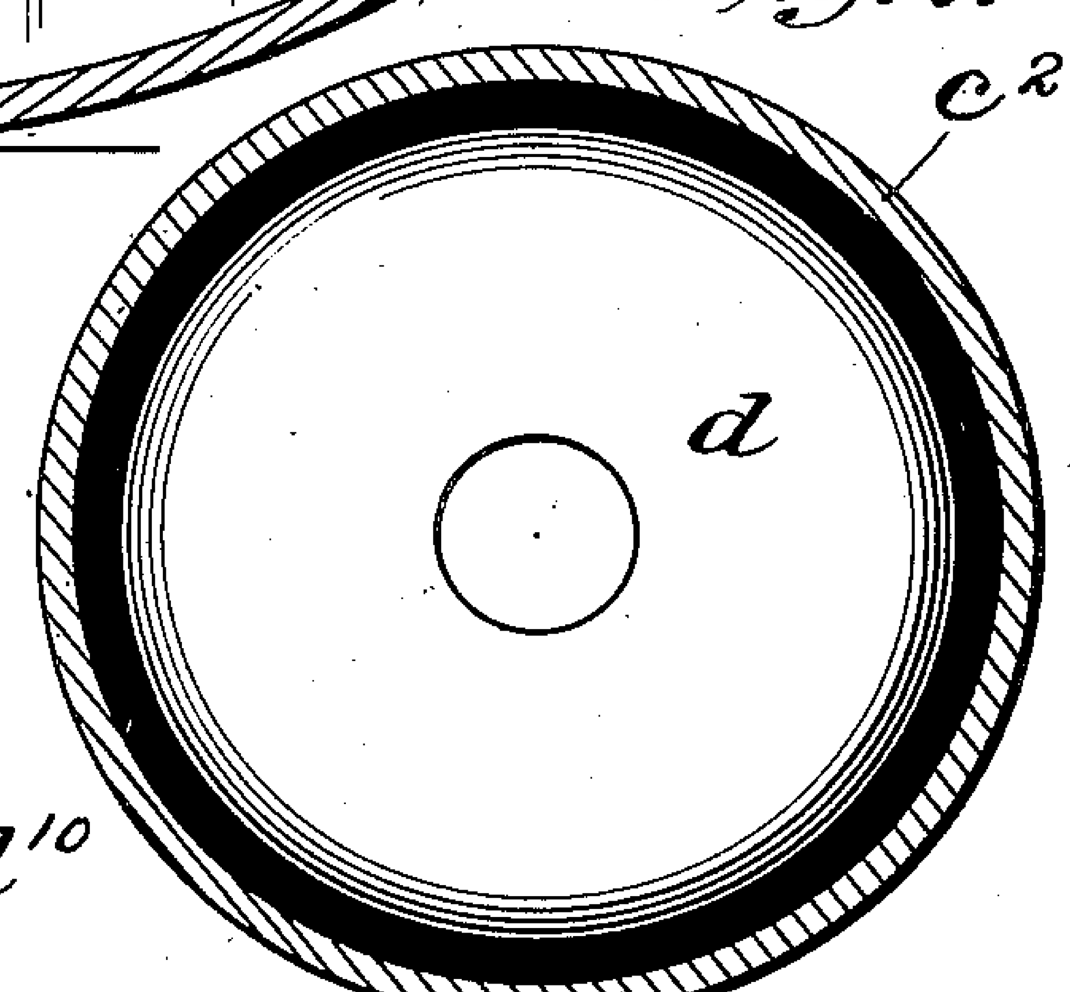


Fig. 7.



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4 SHEETS—SHEET 4.

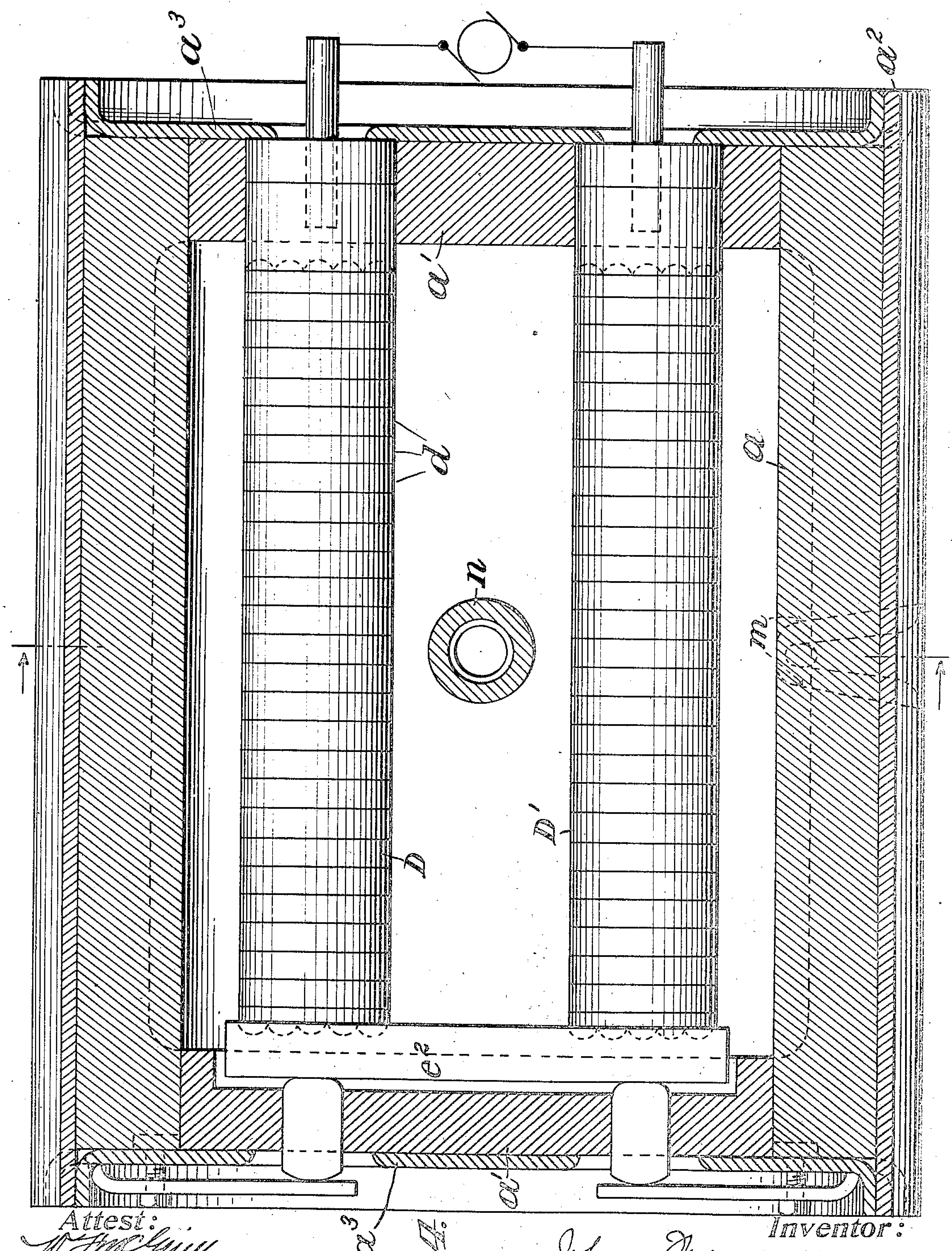

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOHN THOMSON, OF NEW YORK, N. Y., ASSIGNOR TO IMBERT PROCESS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRIC FURNACE.

950,880. Specification of Letters Patent. **Patented Mar. 1, 1910.**

Application filed September 1, 1909. Serial No. 515,699.

To all whom it may concern:

Be it known that I, JOHN THOMSON, a citizen of the United States, and a resident of the borough of Manhattan of the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

The invention relates more particularly to improvements in revoluble or oscillatory electric furnaces, although some of the features thereof may be applied to electric furnaces of other types.

The object of the invention in the main, however, has been to incorporate in the revolving type of furnace a resister embodying the improvements described in an application filed concurrently herewith, Serial Number 515,698. In such application, a resister is set forth having a plurality of members or elements which are arranged to interlock with each other and thus to form a resister which is self sustaining and which lends itself readily to application in various types of furnaces.

For a more detailed explanation of the principles and general application of the said resister, reference should be had to the application above alluded to, the following description being concerned chiefly with its application in the particular type of furnace under consideration.

Referring now to the drawings,—Figure 1 is a transverse central section of a revolving furnace embodying the invention. Fig. 2 is a longitudinal central section thereof. Fig. 3 is a view similar to Fig. 1, showing another embodiment of the invention in an oscillatory furnace. Fig. 4 is a horizontal section through the furnace shown in Fig. 3, the plane of the section being indicated by the line 4—4 in Fig. 3. Figs. 5 and 6 are enlarged detail views in elevation and central section respectively, of disks which may be employed in building the resister, and, Fig. 7 is, similarly, an enlarged detail, showing, in elevation, another form of resister element which may be employed and, in section, a shield for the resister.

Referring generally to the component parts of both forms of furnaces illustrated herein, a denotes the cylindrical body and a' the heads of the furnace, both of which are constructed of suitable brick work. Surrounding the cylindrical portion of the furnace is a steel casing a^2 to which flanged steel heads a^3 are secured.

In Figs. 1 and 2, the furnace is provided with rollers a^8, while in Figs. 3 and 4 the furnace is adapted to be rolled or oscillated back and forth upon the floor which is indicated at a^9.

As in general the same reference letters are used to refer to corresponding parts in both cases, it will be unnecessary to describe or refer to all parts in connection with each of the furnaces which are illustrated herein.

The resister is shown to be composed of a plurality of disks d the faces of which are concentrically fluted, the raised or curved portions of one disk fitting into the depressed or concave portions of the next disk and so on. With such flutings, a high resistivity may be obtained inasmuch as the contacts between adjacent disks will consist only of a few concentric circular lines; but if a low resistivity is desired then the disks instead of being fluted may be formed with V-shaped grooves, for instance, thereby increasing the physical contact between adjacent disks and consequently the conductivity of the resister as a whole. As thus constituted, the resister is disposed between the terminals e and e' by which, on account of the interlocking of its elements, it may be wholly supported.

In Figs. 1 and 2 the resister consists of a single section which is placed along the central axis of the furnace chamber, the disks upon each end of the resister being interlocked, as shown in Fig. 2, with the terminals. The latter, in order to prevent loss of heat, are preferably backed with refractories e^{11}, one of which, as shown at the left of Fig. 2, is movable so as to compensate for any expansion or contraction of the disks, in the operation of the furnace, due to thermal changes. In order to maintain the movable refractory e^{11} at all times in engagement with the end of the resister, so as to confine the disks against end displacement and at the same time to permit said disks to expand freely when highly heated, resilient means are employed to retain said movable refractory. In the present case, as shown in Fig. 2, the thrust of the right hand terminal is resisted by the corresponding refractory e^{11} and thence by the steel head piece a^2 upon that side, while the imparted pressure is transmitted to the left hand terminal from the movable refractory e^{11} by a spring or yielding member or members e^7 secured by bolts and nuts e^8 to the left hand steel head piece e^2. In this way, just such an amount of initial pressure may be applied as will properly maintain the resister whereby the latter may expand when heated or retract when cooled without sensibly affecting the electrical contact resistance. Moreover, resilient clamps might be applied at both terminals, as well as at one terminal, in which case the expansion and contraction will be right and left of center; and in a resister of considerable length, such a construction will probably be the preferable.

When the furnace is to be used with an oxidizing atmosphere in the melting chamber, or when the gases given off by the charge are of such character as would act detrimentally upon the resister, a protecting casing or shield c^2 (Figs. 1, 2 and 7) may be employed to envelop the resister. This casing may be of any suitable material, different from that of the resister, best adapted for the purpose and it may be built into the heads of the furnace so as to leave a clear concentric space between the inner surface thereof and the outer surface of the resister, as shown. It will be apparent that as this shield will not be subjected to any strain beyond that of its own weight, it can be of the least thickness which it is possible to mold, so as to prevent a minimum obstruction to the passage of heat.

To indicate the wide application of this invention and its adaptability to the voltages of commerce, a compound resister is shown in Figs. 3 and 4, the two sections thereof, D and D′, being connected up in series by the connector piece e^2. In this instance, the resister sections are set out of the center of the melting chamber for a reason to be pointed out later on.

In the construction shown in Fig. 1, there is a single plugged opening from the furnace chamber, and this is usually sufficient both for charging and emptying the furnace, especially when the operation is carried on intermittently. But in cases where the operation is to be carried on continuously and where the exclusion of air during the charging is of importance, as in the melting of aluminum or various alloys, then, as in Figs. 3 and 4, a tap-off spout m may be applied and the material to be fed may be introduced through a refractory tube n whose inner open end enters the bath and is sealed thereby. In this wise, the tube can be kept more or less filled, as shown, with the material to be charged, and the latter will follow down as rapidly as melted. Moreover, the rate of fusing can be hastened by a slight rocking of the furnace thereby causing the bath to flow back and forth bringing the hotter metal in contact with the colder.

Referring to Fig. 1, if the center of the resister coincided with the center of a cylindrical chamber, as indicated by the broken line o, this form of chamber and disposal of the resister would be the worst possible to realize the radiant heat in effective work upon the charge, in that the heat waves radially emitted by the resister would make "point-blank" impingements against all portions of the refractory not covered by the bath; and as the latter presents a flat surface the waves are refracted therefrom except precisely on a vertical center line. In other words, regarding the heat waves as having material weight impelled at very high velocity, all of their energy would be absorbed by the refractory and only a portion thereof by the bath. And it is a well known fact that in the operation of revolving furnaces, heated by electric arcs or centrally fuel-fired, a relatively rapid revolution is necessary to absorb the stored temperature of the refractory surfaces. Even as it is, however, the revolving cylindrical furnace shows a material increase of efficiency over the fixed chambers, as ordinarily designed.

To obviate the foregoing objections, especially when a single central resister is used, the hearth may be formed in eight curved, or sloped, sections, as shown in Fig. 1. The consequence of this is that all of the heat-waves impinging upon the refractory below the horizontal center plane of the chamber, when in any one of the four positions such as is shown in the drawing, will be refracted toward the bath, while the heat waves above will be refracted right and left against themselves. This is indicated by the arrows, those marked x implying direct rays and those marked z indirect or refracted rays. In this wise, a considerable portion of the energy that would otherwise be dissipated will be usefully conserved. The construction whereby to obtain this result is entirely feasible in practice, simply requiring that the refractory bricks be molded to the desired form. Moreover, the contour of the several hearths is such as to effect a very much better commingling of the bath than is the case in a circular chamber. Again, when a compound resister is employed as in the arrangement shown in Figs. 3 and 4, then the chamber may well be circular in section; for, as the centers of the resisters are eccentric to the center of the chamber there will only be two "point-blank" impingements, as r and s, of the heat waves, all of the others being deflected.

While in the foregoing, the elemental

parts of the resister have been referred to and described as disks, and particularly as fluted disks, they may equally well be formed to interlock as hexagonal or square plates; and separate rings or rods, either solid or hollow, may be used to interlock a set of grooved disks or plates, as in the case of the resister described in the application above referred to. Moreover, as illustrated in Figs. 1 and 7, the disks may be formed with a central opening which may be left open or filled with a refractory or granular carbon, such openings being convenient in the introduction or removal of the resister. Again, a slot or opening d^{10} may be provided across the concentric flutings or grooves in order to permit a more rapid escape of the heat from the concentric or depressed spaces and the center of the resister. (Figs. 5 and 6).

It was noted above that the resister illustrated in Figs. 3 and 4 is herein shown and described to indicate the wide application of the invention and its adaptability to the voltages of commerce; and, while claims for this specific form of furnace are to be made in another case, the illustration and explanation of the same herein will serve to make the present invention more completely understood and appreciated.

I claim as my invention:

1. A revoluble electric furnace having a resister composed of interlocked members.

2. A revoluble electric furnace having a resister composed of interlocked disks.

3. A revoluble electric furnace having a resister composed of grooved disks.

4. A revoluble electric furnace having a resister composed of concentrically fluted plates.

5. A revoluble electric furnace having a resister composed of a plurality of elements and suspended therein by the interlocking of the elements.

6. A revoluble electric furnace having a resister composed of a plurality of elements and supported wholly from and between the terminals by the interlocking of said elements.

7. A revoluble electric furnace having a resister composed of interlocked members engaged by the terminals.

8. A revoluble electric furnace having a resister composed of a plurality of members interlocked with each other and with the terminals.

9. A revoluble electric furnace having a resister composed of grooved plates and having slots to permit the free escape of heat from the interior.

10. A revoluble electric furnace having a core composed of interlocking carbons.

11. A revoluble electric furnace having a resister composed of interlocked members and means to clamp said members together resiliently.

12. A revoluble electric furnace having a resister composed of interlocked elements and means to compensate for the expansion and contraction of the same due to thermal changes.

13. A revoluble electric furnace having a resister composed of interlocked elements, and a terminal for the resister which is movable to compensate for the expansion and contraction of the elements due to thermal changes.

14. A revoluble electric furnace having a resister and a shield enveloping the same but not in contact therewith.

15. A revoluble electric furnace having a resister and furnace walls arranged or formed so that the heat waves emitted by the resister shall impinge upon the exposed portions of the walls at angles of less or more than ninety degrees.

16. A revoluble electric furnace having a resister centrally located therein and surrounded by a plurality of hearths formed in such manner that all of the exposed portions of said hearths shall receive the heat waves emitted by the resister at angles of less or more than ninety degrees to the lines of radiation.

This specification signed and witnessed this 31st day of August, A. D., 1909.

JOHN THOMSON.

Signed in the presence of—

M. Rollins,

G. McGrann.