

No. 772,077.

PATENTED OCT. 11, 1904.

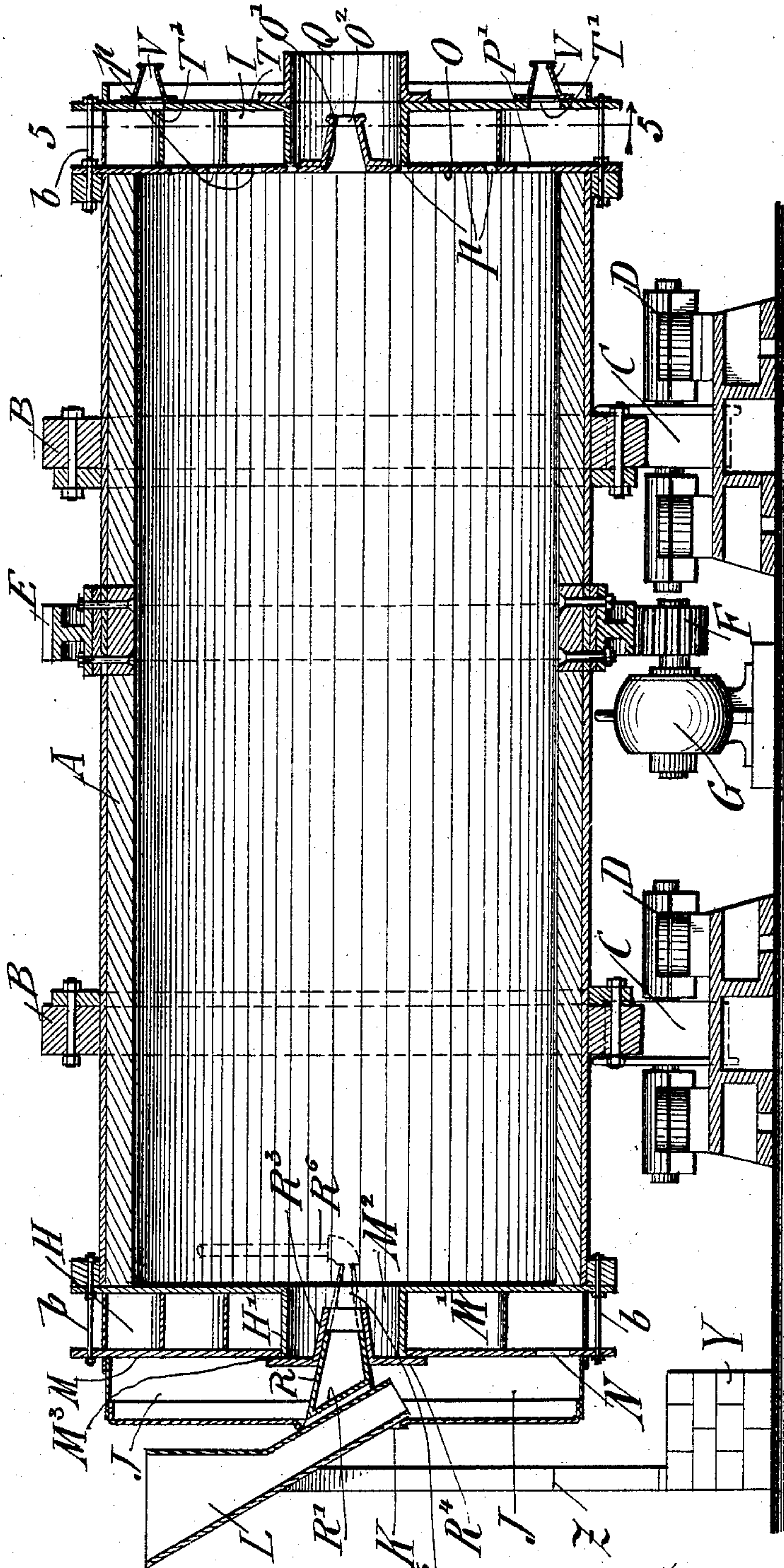
M. F. ABBÉ.
TUBULAR BALL MILL.

APPLICATION FILED OCT. 15, 1903.

NO MODEL.

3 SHEETS—SHEET 1.

Fig: 1.



Witnesses
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For
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By his Attorneys
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3 SHEETS—SHEET 2.

Fig. 3.

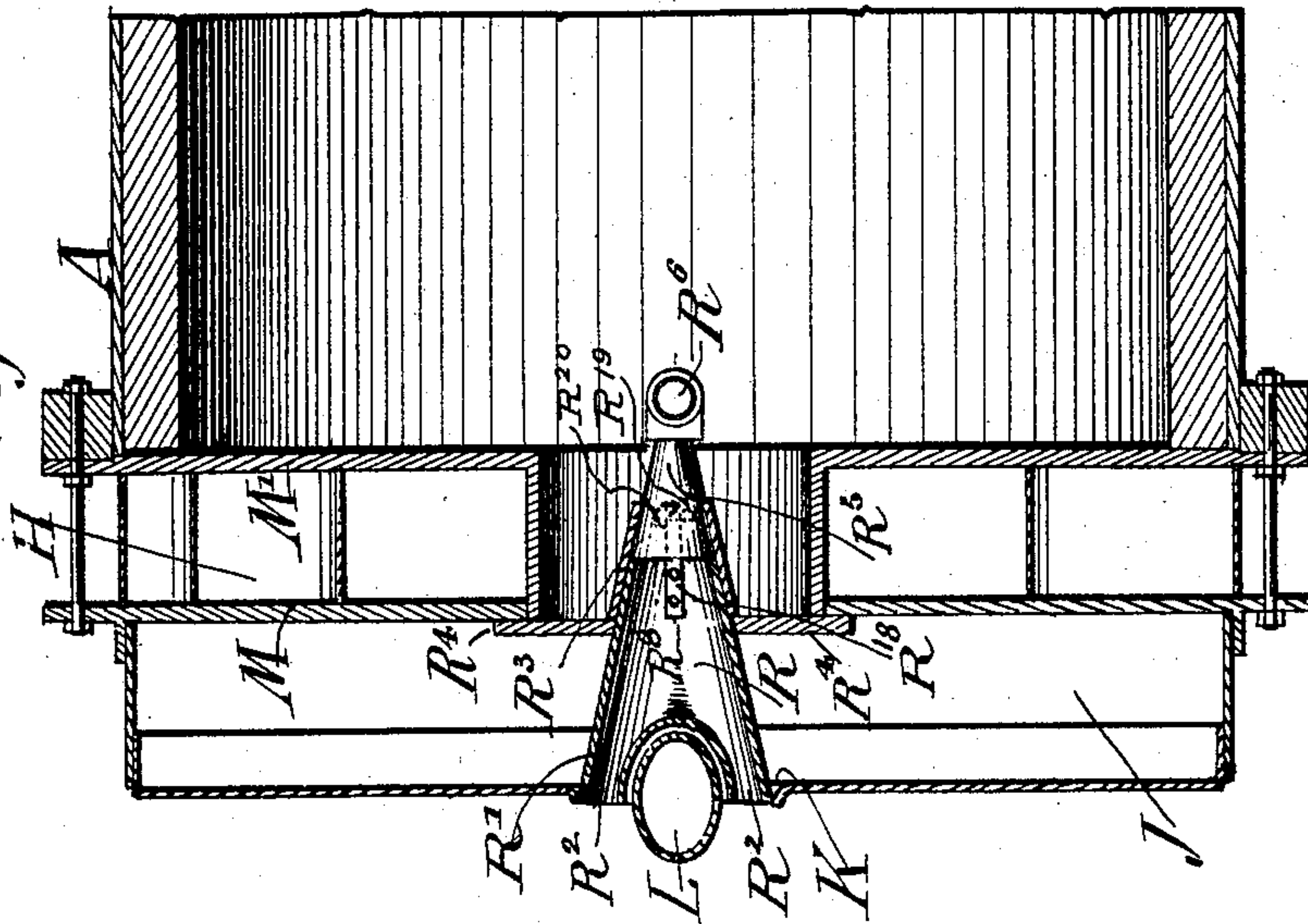
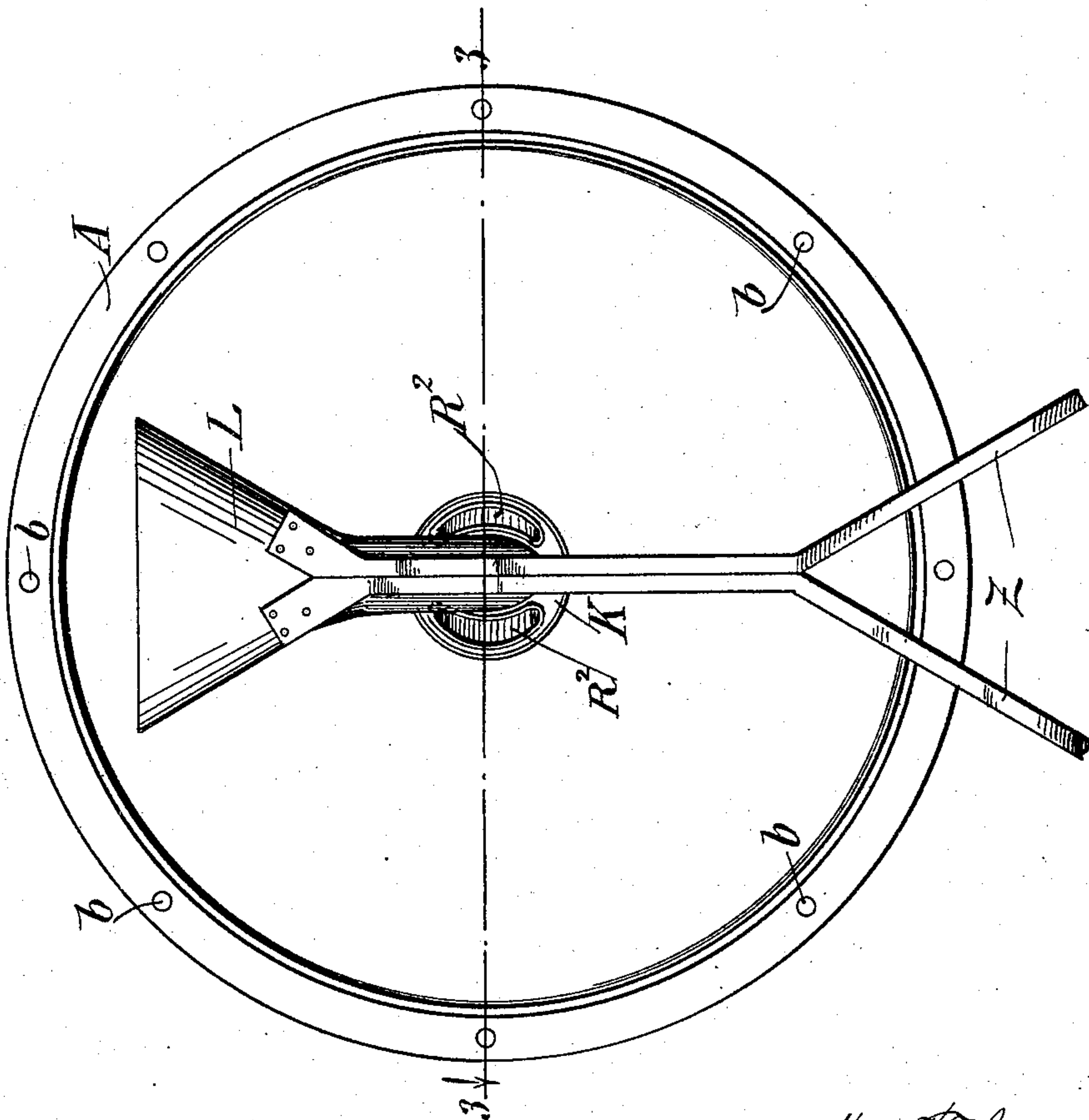


Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 5.

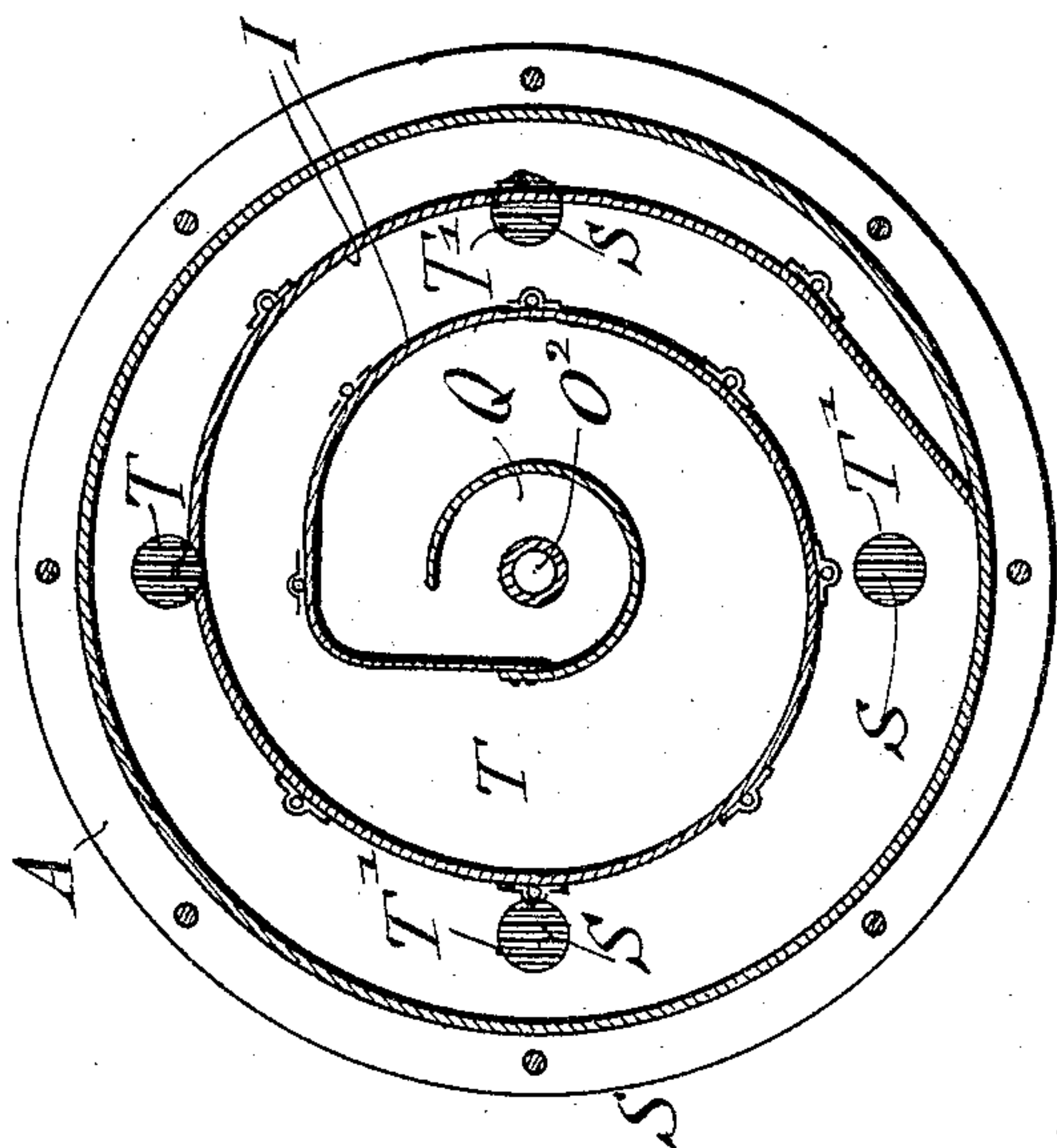


Fig. 8.

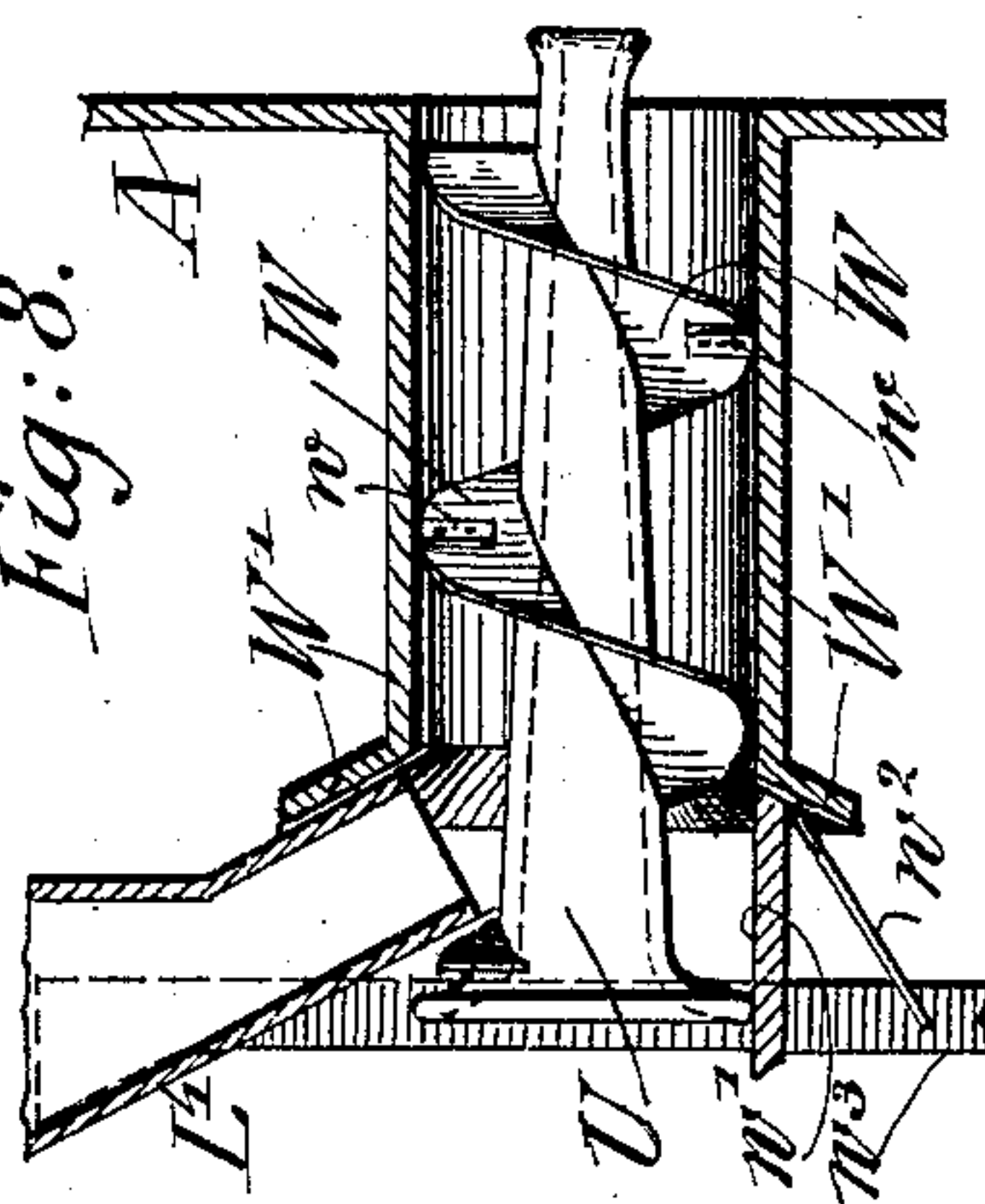


Fig. 7.

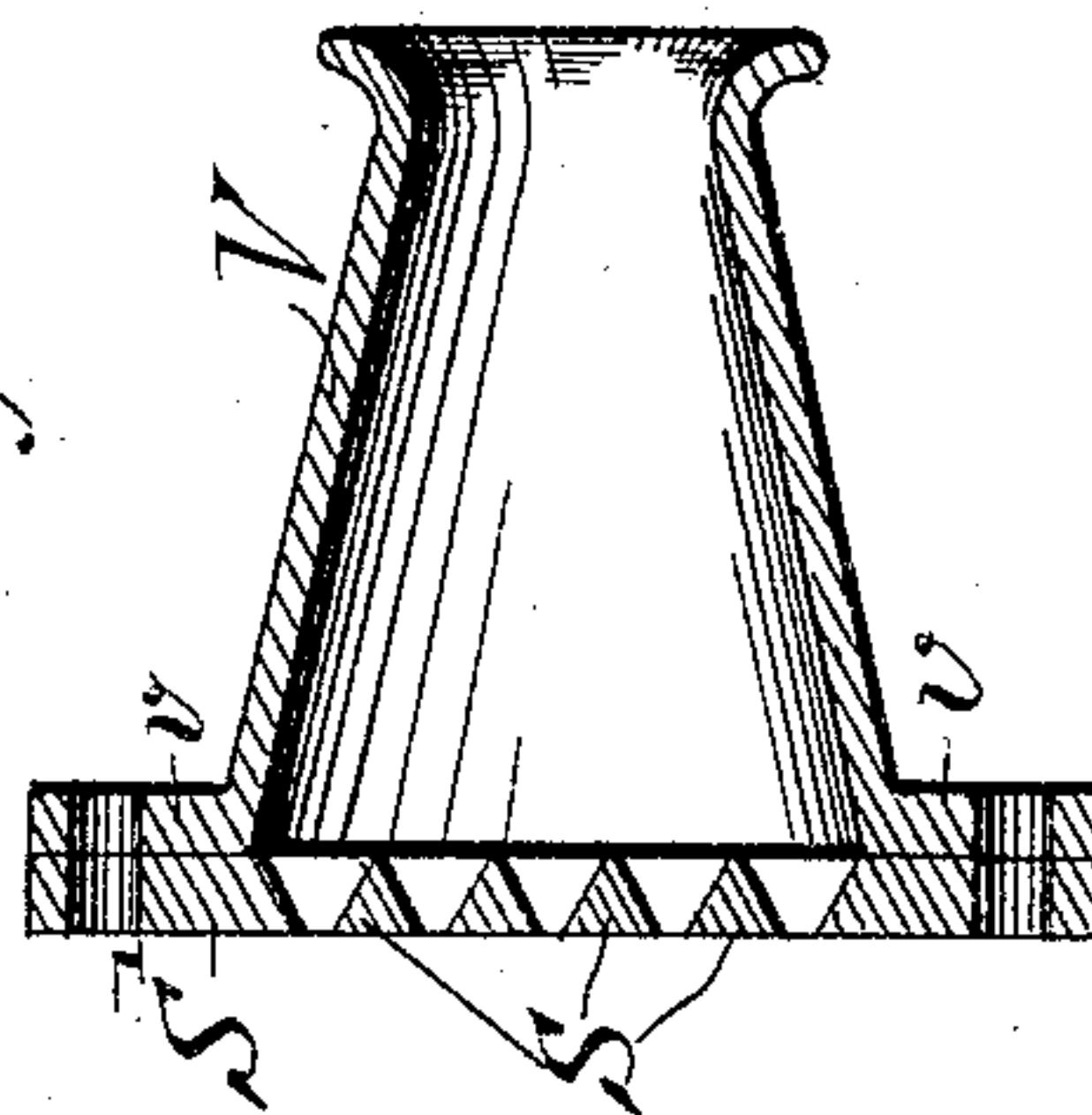


Fig. 4.

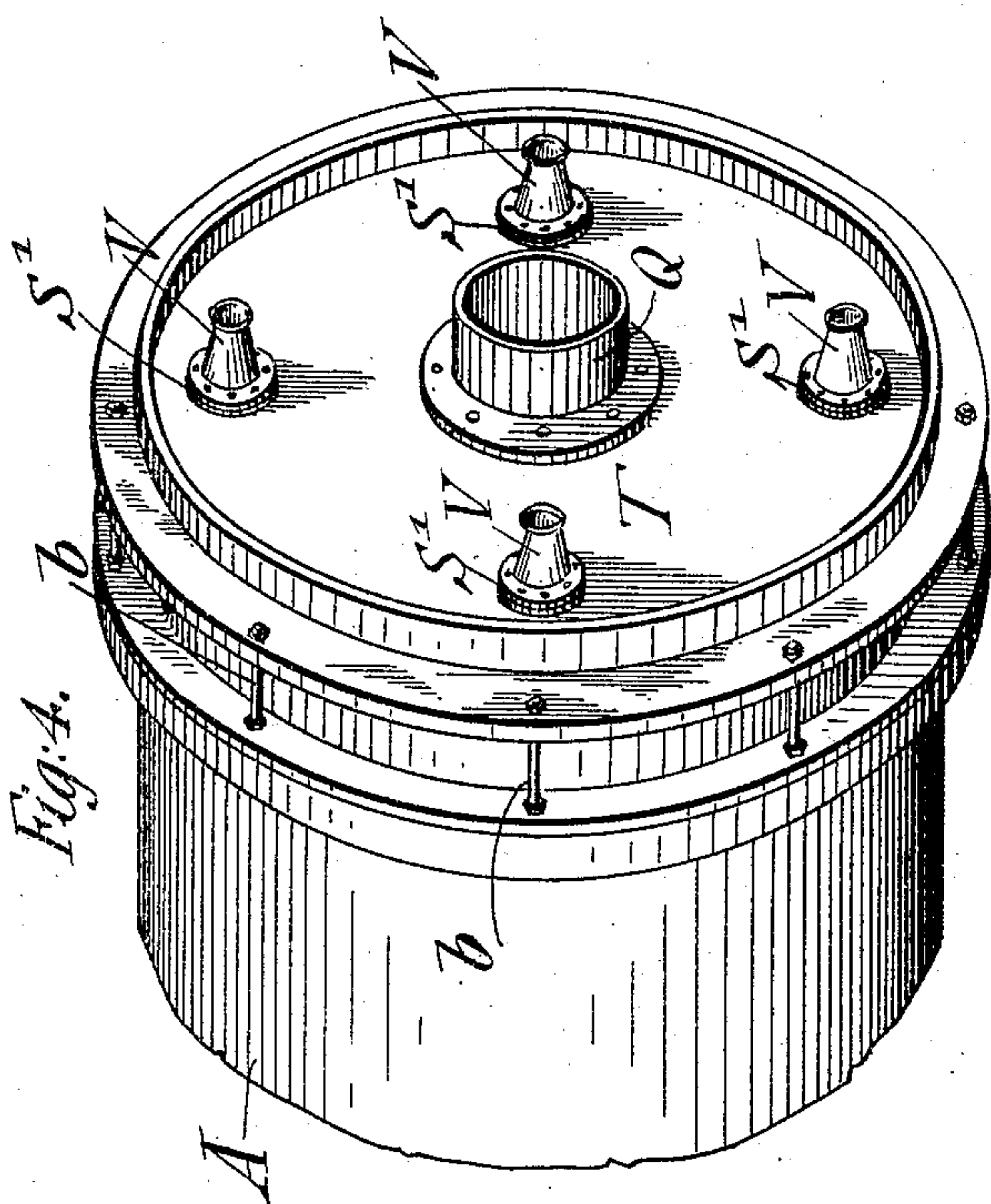
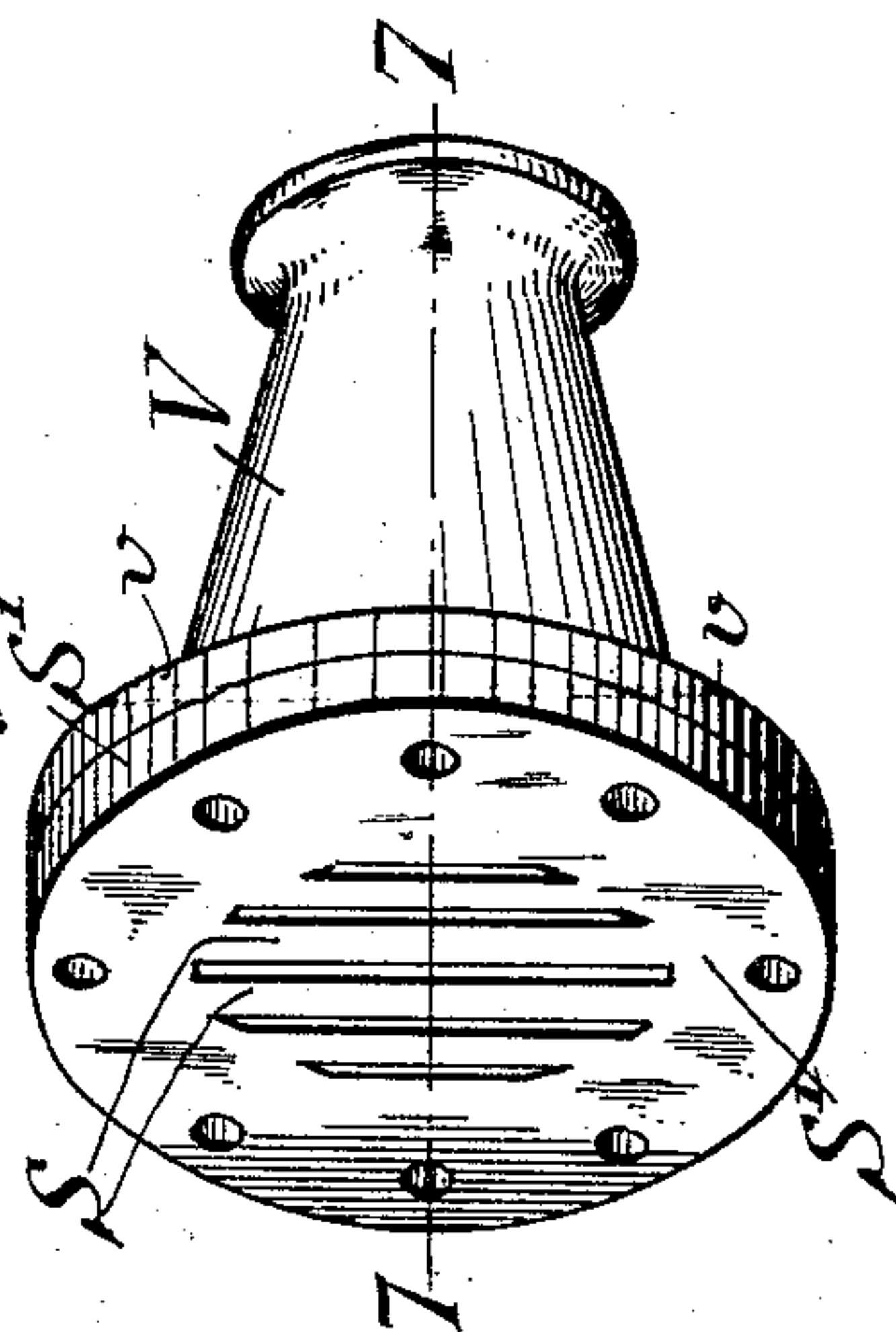


Fig. 6.



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UNITED STATES PATENT OFFICE.

MAX F. ABBÉ, OF NEW YORK, N. Y.

TUBULAR BALL-MILL.

SPECIFICATION forming part of Letters Patent No. 772,077, dated October 11, 1904.

Application filed October 15, 1903. Serial No. 177,220. (No model.)

To all whom it may concern:

Be it known that I, MAX F. ABBÉ, a citizen of the United States, residing in New York, borough of Manhattan, and State of New York, have invented certain new and useful Improvements in Tubular Ball-Mills, of which the following is a specification.

In grinding and mixing moist materials in the presence of lime it has been found that considerable heat is generated, which causes the water in the materials to evaporate and form steam, which gathers in the upper part of the mill. The steam so formed condenses on the walls of the mill, forming water of condensation, which returns to the lower part of the mill and keeps the material continually in a moist condition. This reduces the efficiency of the mill and the quality of the material produced.

This invention relates to tubular ball-mills, and has for its object to obviate the objections above referred to.

For this purpose the invention consists of a tubular ball-mill comprising certain novel features and combinations of parts, which will be more fully described hereinafter, and finally pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section of a tubular mill provided with my improvements. Fig. 2 is an elevation of the feed end of the same. Fig. 3 is a horizontal section taken on line 3 3 of Fig. 2. Fig. 4 is an elevation of the discharge end of the mill. Fig. 5 is a vertical transverse section of the discharge end of the mill, taken on line 5 5 of Fig. 1. Fig. 6 is an elevation of one of the extensions adapted to be fastened to the discharge end of the mill. Fig. 7 is a longitudinal section of the same, taken on line 7 7 of Fig. 6; and Fig. 8 is a longitudinal section of a modified form of the means used for feeding material to the mill.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents a horizontally-arranged rotatable cylinder of a tubular ball-mill which is provided with circular rims B, bearing on wheels C, the axes of which are rotatable in bearings D. A suit-

able motor G, the shaft of which is provided with a pinion F, meshing with a gear-wheel E on the circumference of the cylinder, serves to rotate the cylinder. The cylinder of the mill shown in the drawings is provided at the ends with spiral ways, a feedway H at one end of the mill for the entrance of the material and a discharge-way I at the other end of the mill for the exit of the material. Each of these spiral ways is inclosed by two partitions, secured to each other by bolts b. The outer partition M of the feedway H is provided with an opening N for the passage of the material from a feed-chamber J, arranged exterior to the feedway and having a central opening K. A stationary hopper L, supported by a stay Z, secured to the foundation Y, protrudes through this opening, so as to discharge the material into the feed-chamber J, from which it passes through the opening N of the partition M into the spiral feedway H and is forced by means of the same into a cylindrical central portion H', from which it falls into the interior of the cylinder, the partition M' being provided with a central opening M². A partition O at the other end of the cylinder is provided with an opening P, through which the ground material passes into the spiral discharge-way I, by means of which it is discharged into a central cylindrical part Q and to receptacles placed beneath the same.

In grinding wet materials in the presence of lime it has been found that steam is formed in considerable quantities, which condenses in the upper part of the mill, whereby the water of condensation moistens the partially-dried material. To prevent this, it is necessary to provide the mill with means whereby the air may enter and pass through the interior of the mill, causing an efficient circulation, but at the same time preventing the ground material from passing through such means. The air entering independently of the material is dry and causes an efficient circulation in the mill from one end to the other, thereby permitting the mill not alone to act as a grinder and mixer, but simultaneously to act as a dryer. For this purpose the partition M of the feed end of the mill is provided with a central opening M³, through which a

stationary pipe R projects. This pipe is preferably conical in shape and is provided at its larger end with a bifurcated part R', the ends of which envelop the lower part of the feed-hopper L and form oval-shaped openings R² at each side of the same. As this pipe R is stationary while the mill revolves, the central opening M³ of the partition M is provided with a conically-shaped part R³, which extends somewhat beyond the end of the conically-shaped part or circular end of the bifurcated pipe R toward the interior of the mill and having its flanges R⁴ suitably attached to the partition. By this arrangement the dry air may freely enter the mill independently of the material fed into the same, while at the same time the material is prevented from passing from the mill into the conically-shaped part R³. This result is attained by the conical or converging shape given to this part R³. In case the mill is almost or more than half full the material might enter the opening of the conically-shaped part R³. This would not be desirable, for which reason an extension R⁵, provided with a pipe R⁶, extending toward the upper part of the cylinder, is detachably secured to the part R by a bayonet-joint connection R⁸, which consists of a member R¹⁸, secured to the part R and provided with a hook-shaped lug R¹⁹, engaging the second member R²⁰, secured to the extension R⁵ of the pipe R⁶. By these means the extension R⁵ of the pipe R⁶ may be readily attached to the part R before assembling the various parts of the mill or readily detached when disassembling the same. The extension R³ overlaps the adjacent ends of the bifurcated pipe R and the extension R⁵ of the pipe R⁶, so as to prevent any of the material being fed into the mill from passing between the adjacent ends. The pipes R and R⁶ serve to conduct air from the exterior to the interior of the cylinder and have for their object to prevent the return of the material from the interior to the exterior.

To provide for the exit of the air, together with the steam generated in the mill, the partition O of the discharge end is provided with a central opening O' and with a conically-shaped or converging part O² extending into the cylindrical part Q of the mill. Here again the air may pass through, preventing, however, the return of the ground material. In cases where the mill is more than half full or it should be otherwise found desirable the partition O is provided with a plurality of perforations p, which permit the air, steam, and ground material to pass through the same into the spiral discharge-way I. Such openings, however, for the reason that they permit the ground material to pass through, would not be practical on the outer partition T of the discharge end, and for this reason the partition is provided with openings T', which are partially covered by foraminated

plates, screens, or, preferably, bars S, forming grates. The bars S are triangular in shape and placed to expose their flat surfaces to the openings and to the interior of the mill, while their pointed ends extend toward the exterior of the mill. By this arrangement material can only pass with difficulty from the inside to the outside of the mill, but may easily pass from the outside to the inside. For convenience of manufacture the grate-bars S may be cast integrally with a plate S'. In order to cause the material which has passed through the grate-bars S to be returned again into the discharge-way I of the mill, conically-shaped or converging extensions or nozzles V are provided, the flanges v of which may be fastened together with the grate-bar plates S' to the partition T of the mill.

The material having passed through the openings between the grate-bars S is dropped on the interior walls of the extension V and caused to be returned through the grate-bars during the revolution of the mill when this extension arrives near the upper part of the mill. Means for causing an efficient circulation of air in a tubular mill provided with spiral ways at either end have been described. These means are with slight modifications equally adapted for mills having a spiral feed, as shown in Fig. 8. In this case the spiral feed W, attached by plates w to a cylindrical extension W' of the cylinder A' of the mill, is provided with a central conically-shaped or converging shaft U for the passage of air independently of the material into the interior of the mill. The hollow converging shaft U is flaring at either end and extends somewhat beyond the cylindrical extension W'. To prevent any material from falling, a plate w' is provided, which is supported by a brace w², attached to a standard w³, which supports the hopper L'.

By my improved means, which are equally simple to construct, repair, and clean, the efficiency of tubular ball-mills may be considerably increased, inasmuch as they may be used simultaneously as grinders and driers. The special conical shape given to the extensions causes the air passing through the same to partake of a comparatively high velocity, whereby the circulation in the mill may be considerably increased, while at the same time the ground material is prevented from passing through the same.

I claim as new and desire to secure by Letters Patent—

1. In a tubular ball-mill, the combination with a cylinder provided with a spiral feed-way at either end for the entrance and discharge of material, of a feed-chamber exterior to the spiral feedway provided with a central opening, a stationary hopper passing through the central opening and discharging into the feed-chamber, and a bifurcated pipe provided with oval-shaped openings at one

end, one opening arranged at either side of the stationary hopper, and with one circular opening at the other end terminating in the central part of the spiral feedway for conducting the air from the exterior to the interior of the cylinder, substantially as set forth.

2. In a tubular ball-mill, the combination with a cylinder provided with a spiral feedway at either end for the entrance and discharge of material, of a feed-chamber exterior to the spiral feedway provided with a central opening, a stationary hopper passing through the central opening and discharging into the feed-chamber, a bifurcated pipe provided with oval-shaped openings at one end and arranged at either side of the stationary hopper and with a circular opening at the other end terminating in the central part of the spiral feedway, a conically-shaped extension in the central part of the spiral feedway, attached to the same and concentric and in close proximity to the circular end of the bifurcated pipe, and extending inwardly some distance beyond the circular end of the bifurcated pipe, said pipe and conical extension being adapted to conduct air from the exterior to the interior of the cylinder and adapted to prevent the return of the material from the interior to the exterior of the cylinder, substantially as set forth.

3. In a tubular ball-mill, the combination with a cylinder provided with a spiral feedway at either end for the entrance and discharge of material, of a feed-chamber exterior to the spiral feedway provided with a central opening, a stationary hopper passing through the central opening and discharging into the feed-chamber, a bifurcated pipe provided with oval-shaped openings at one end arranged at either side of the stationary hopper and with a circular opening at the other end terminating in the central part of the spiral feedway, a conically-shaped extension in the central part of the spiral feedway attached to the same and concentric and in proximity to the circular end of the bifurcated pipe, and a pipe detachably connected with said bifurcated pipe extending to the upper interior part of the cylinder, said conical extension being adapted to overlap the adjacent ends of the bifurcated and detachable pipes, and said pipes being adapted to conduct air from the exterior to the interior of the cylinder and adapted to prevent the return of the material from the interior to the exterior, substantially as set forth.

4. In a tubular ball-mill, the combination with a rotatable cylinder having feed and discharge means at its ends, said discharge end being provided with openings, of foraminated coverings for said openings, conically-shaped extensions for said coverings projecting outwardly from the cylinder and converging in outward direction, adapted to permit the pas-

sage of air and adapted to return to the interior of the cylinder, during the rotation of the same, the material which passes through the foraminated coverings, substantially as set forth.

5. In a tubular ball-mill, the combination with a rotatable cylinder having feed and discharge means at its ends, said discharge end being provided with openings, of foraminated plates attached to the ends of said cylinder for covering said openings, and conically-shaped extensions attached to said plates projecting outwardly from the cylinder and converging in outward direction, said extensions being adapted to permit the passage of air and adapted to return to the interior of the cylinder, during the rotation of the same, the material which passes through the foraminated coverings, substantially as set forth.

6. In a tubular ball-mill, the combination with a cylinder provided with a spiral way at either end for the entrance and discharge of the material, said discharge-way being arranged between the end of the cylinder and a partition parallel to the same, said partition being provided with a plurality of perforations throughout the surface of the same, while the end of said cylinder is provided with a plurality of openings, of foraminated coverings for said openings, and conically-shaped extensions attached to the end of the cylinder and projecting outwardly from the same, and converging in outward direction, being adapted to permit the passage of air and adapted to return to the interior of the cylinder the material which passes through the foraminated coverings, substantially as set forth.

7. In a tubular ball-mill, the combination with a cylinder provided with a spiral way at either end for the entrance and discharge of the material, the end of said cylinder being provided with a plurality of openings, of foraminated coverings for said openings, conically-shaped extensions attached to the end of the cylinder and projecting outwardly from the same and converging in outward direction, being adapted to permit the passage of air and adapted to return to the interior of the cylinder the material which passes through the foraminated coverings, and a conically-shaped extension central to the spiral discharge-way for the passage of air to the interior of the cylinder, said discharge-way being adapted to prevent the passage of the material from the interior to the exterior of the cylinder, 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.

MAX F. ABBÉ.

Witnesses:

PAUL GOEPEL,
C. P. GOEPEL.