

No. 753,817.

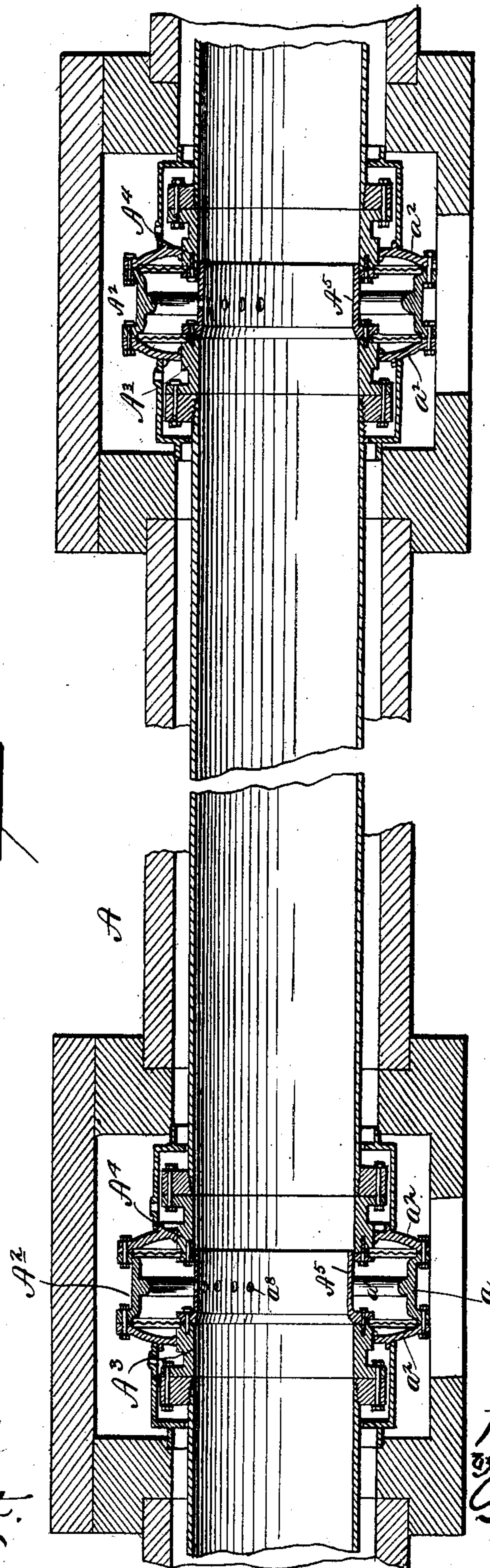
PATENTED MAR. 1, 1904.

W. C. ANDREWS.
APPARATUS FOR SUPPLYING CITIES WITH STEAM.

APPLICATION FILED DEC. 9, 1898.

NO MODEL.

5 SHEETS—SHEET 1.



Witnesses:
J. L. Orand
R. M. Elliott.

Inventor:
Wallace C. Andrews,
by
R. S. Dyerforth,
his Attorney.

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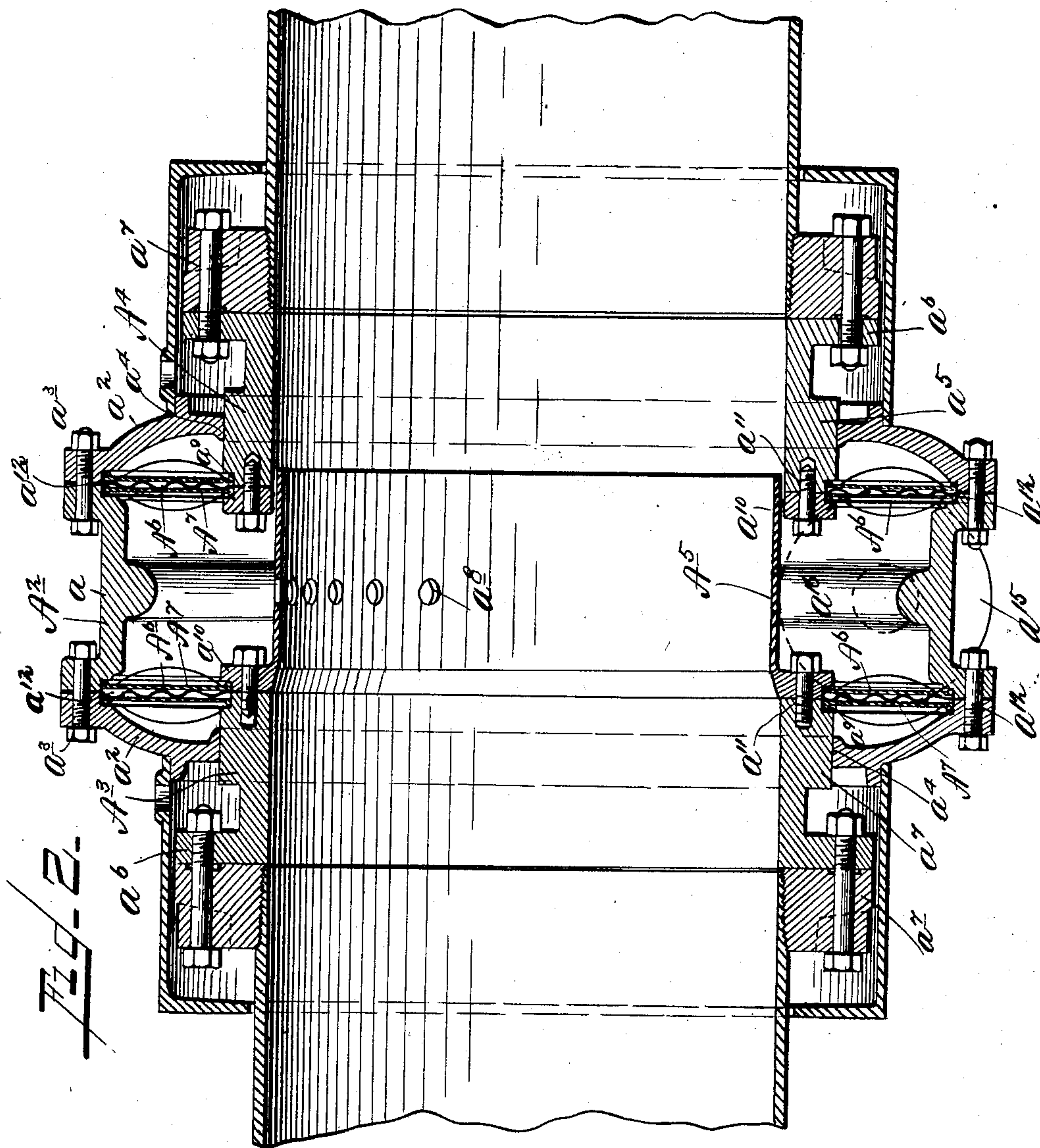
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Witnesses:
Frank L. Ourand.
R. M. Elliott.

Inventor:
Wallace C. Andrews,
by *R. E. Dyerforth*,
his Attorney.

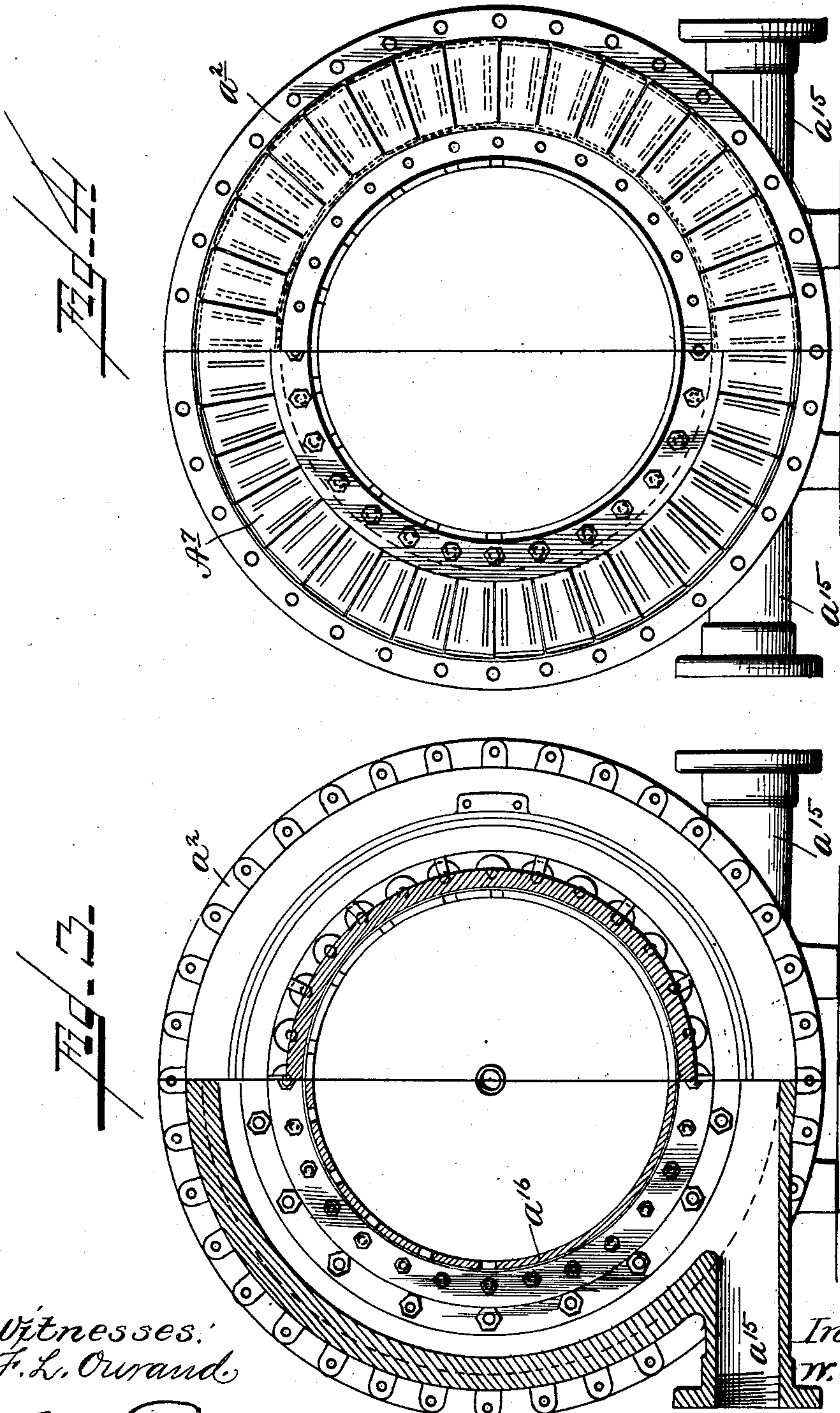
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5 SHEETS—SHEET 3.



Witnesses:
F. L. Ourand
R. M. Elliott.

Inventor:
W. C. Andrews,
by *A. S. Dyer*,
his Attorney.

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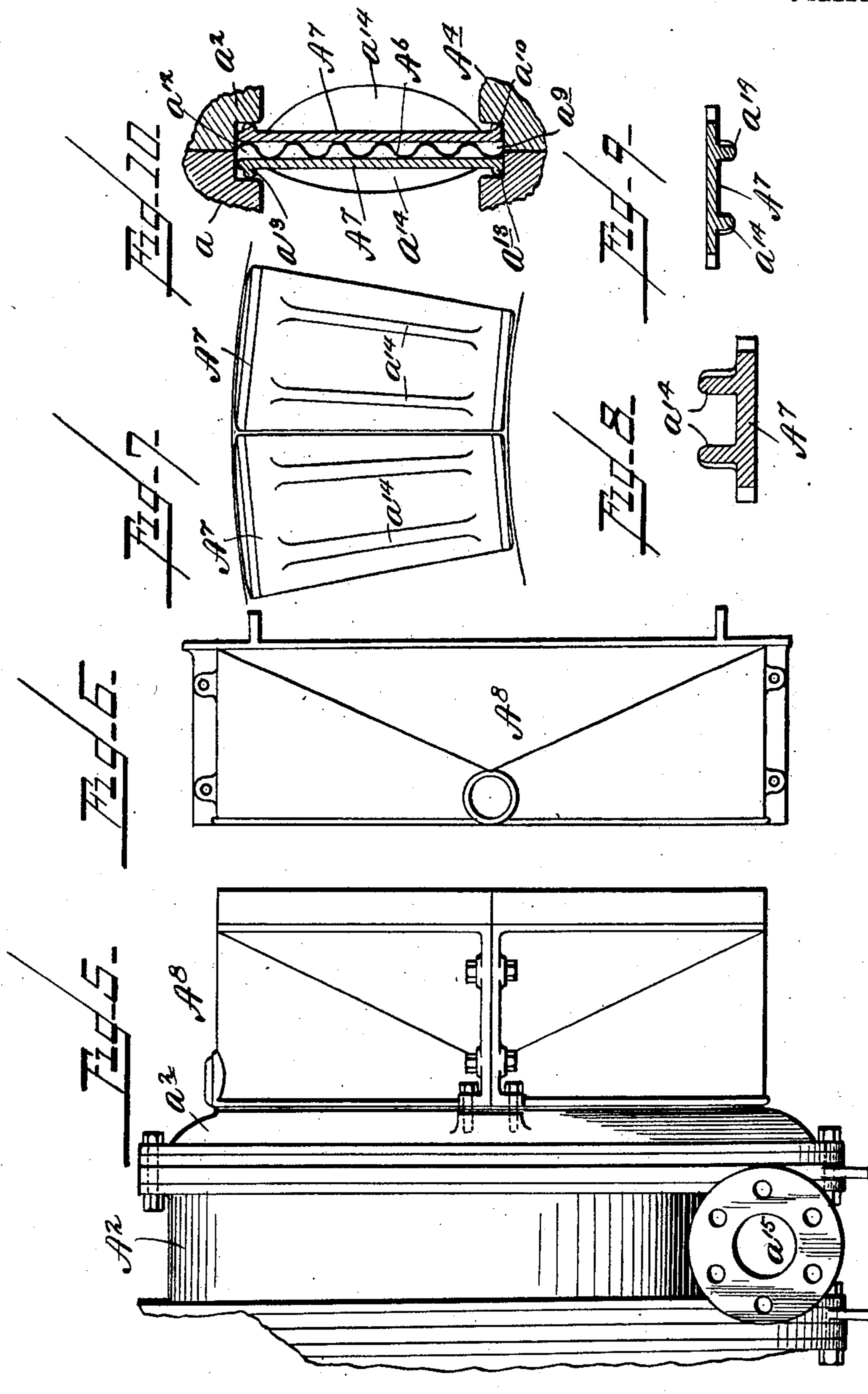
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5 SHEETS—SHEET 4.



Witnesses:

F. L. Ourand

R. M. Elliott,

Inventor:

Wallace C. Andrews,

by *R. S. Dyer*,
his Attorney

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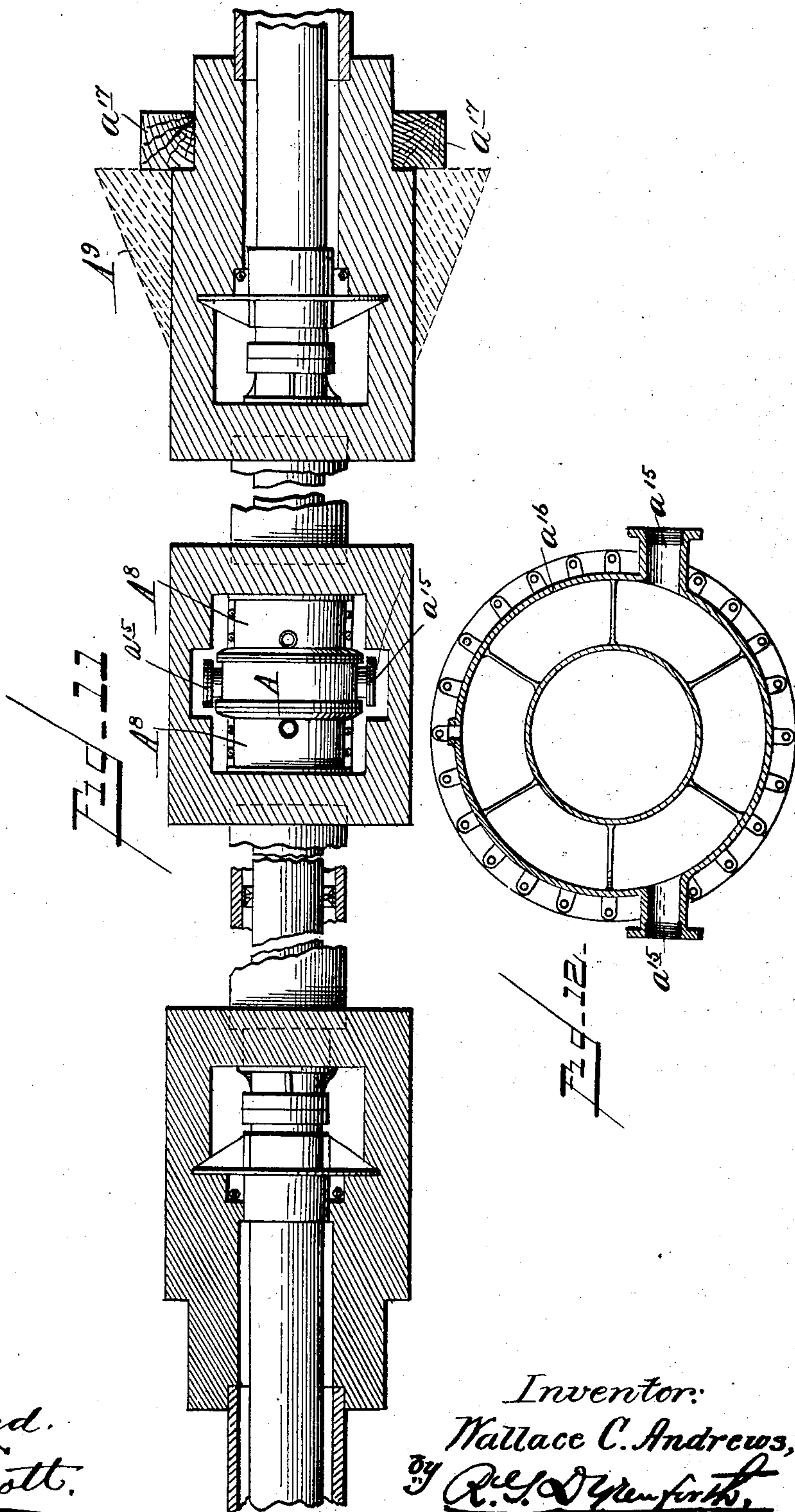
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6 SHEETS—SHEET 5.



Witnesses:
J. L. Ourand.
R. M. Elliott.

Inventor:
Wallace C. Andrews,
by *R. S. Dyke* his Attorney.

UNITED STATES PATENT OFFICE.

WALLACE C. ANDREWS, OF NEW YORK, N. Y.

APPARATUS FOR SUPPLYING CITIES WITH STEAM.

SPECIFICATION forming part of Letters Patent No. 753,817, dated March 1, 1904.

Application filed December 9, 1898. Serial No. 698,729. (No model.)

To all whom it may concern:

Be it known that I, WALLACE C. ANDREWS, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Apparatus for Supplying Cities with Steam; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to variators.

The object is in underground pipe-lines used for conveying steam from a central station or point of generation to different parts of a city for heat and power and without the employment of slip-joints and stuffing-boxes to provide thorough and adequate protection against leakage and explosions caused by ruptures and breaks in the pipes due to constantly-varying strains, both lateral and longitudinal, arising from the effects of alternate expansion and contraction and the variations in the pressure and temperature of the steam passing therethrough; furthermore, to dispense with the employment of manholes at intervals along a pipe-line and to obviate the frequent tearing up of pavements, the latter resulting in serious delays and interruption of traffic, as well the incurrence of heavy expense, and, finally, to provide efficient means for relieving a main or pipe of any water of condensation which might prove injurious to parts of the line and, if desired, run this water into another pipe to be used either for water-heating or for return to the boiler or boilers furnishing the steam.

Briefly stated, the variator characterized by this invention comprises a casing, (constituting one portion of the device,) which in use will be stationary, and two necks constituting the other portion of the device and composing, respectively, an inlet-pipe end or extension and an outlet-pipe end or extension, which in use will be movable with relation to the casing—that is to say, will move to and from the casing under the action of expansion and contraction. A main or pipe is connected with the outer end of each pipe end, and by the arrangement of parts of the variator an un-

interrupted passage is provided through the two sections of pipe.

It is to be understood that there will be one of these variators at specified distances in a pipe-line, and as the operation of each is the same the specific description hereinafter given of one variator will serve for all.

As stated, the necks are adapted for movement to and from the casing, and in order that there may be no rupture of the line it is essential that provision should be made to compensate for the variations in the lengths of the pipe due to changes in the temperature and also to preclude the possibility of a leak occurring at the point where the pipe-sections join the variators. To accomplish this result, two diaphragms are employed which are interposed between the periphery of the necks and the inner walls of the casing and are fixed with relation to the two parts—that is to say, are clamped in place in such manner between the parts of the casing and the parts of the two pipe ends as to prevent escape of steam. The diaphragms perform a function additional to that usually confined to such part in that aside from expanding and contracting under various conditions of pressure for the sole purpose of compensating for variations in the lengths of two pieces of connected pipe they also prevent escape of steam from the interior of the variator without. In conjunction with the diaphragms and on each side thereof a plurality of radially-disposed plates are employed, these plates being suitably reinforced in such manner as to sustain the necks in position for effective work. These plates serve not only to reinforce the diaphragms, but also sustain the necks in such manner as to permit them to move to and from the casing, and in order that the diaphragms may not be restricted in the scope of their usefulness they are preferably corrugated, and these corrugations will yield in accordance with the various lengths assumed by the pipes.

In addition to the parts already named a guard or guide is provided, which may be in the nature of a tube or flange, and projects inward from the inlet-pipe end, this guard operating to bridge the space between the in-

ner opposed ends of the two necks, and thus to prevent any water of condensation or what is known as a "slug" of water from interfering with the operation of the diaphragms.

5 The guard projects beyond the inner terminal end of the outlet-pipe end at the point where the diaphragm is secured in position, so that the flow of steam and water will be carried through the necks and into the main. The
10 upper half, more or less, of this guard is provided with suitable openings through which steam may escape; but the lower half, more or less, is unperforated, so that water of condensation will be prevented from accumulating in the lower half of the casing. This
15 guard is claimed in copending application, Serial No. 114,323, filed July 3, 1902.

To remove any water of condensation that may accumulate in the pipe-line and be carried into the variator-casing, the casing on
20 each side is provided with an outlet or with outlets in which may be tapped a pipe or pipes conveying such water away to a place of use for heating purposes or back to the boiler
25 whence the steam is supplied, thereby in the latter instance operating as a feed-water heater and effecting a saving of fuel. These pipes may also be used for conveying steam to a place of use.

30 By arranging the diaphragms and supporting or reinforcing plates in the manner described the necks will be free to have proper play to compensate for the different lengths of the pipe under different temperatures, and
35 the variator as a whole will be thoroughly efficient for performing the functions for which it is designed.

Further and more specific details of construction will be hereinafter fully described
40 and claimed.

In the accompanying drawings, forming a part of this specification, and in which like letters of reference indicate corresponding parts, there is illustrated a form of embodiment of
45 the invention, it being understood that other forms of embodiment thereof may be employed without departing from the spirit of the same.

In the drawings, Figure 1 is a view in vertical longitudinal section through two of the
50 variators and the attached mains, showing the manner of assemblage of the parts. Fig. 2 is a similar view of one of the variators alone, showing certain parts not seen in Fig. 1. Fig. 3 is a view in elevation, partly in section, looking
55 at the front of the variator, showing the manner in which certain parts of the same are connected. Fig. 4 is a view similar to Fig. 3, showing more particularly the manner in which the radial plates in front of a diaphragm are disposed. Fig. 5 is a view in side elevation of the flange-box. Fig. 6 is a view in
60 plan of the same. Fig. 7 is an enlarged detail view showing the manner in which the plates are assembled with relation to a diaphragm. Fig. 8 is a transverse sectional view

taken through the plate shown at the left of Fig. 7. Fig. 9 is a similar view through the plate shown at the right of Fig. 7. Fig. 10 is a sectional detail view showing the manner
70 in which the diaphragms are positioned between the plates; and Fig. 11 is a view in plan, displaying the manner in which a series of variators are connected up in a line. Fig. 12 is a detached detail view of a spider used in the apparatus. 75

Referring to the drawings, A designates the variator, comprising a casing or shell A^2 , an inlet-pipe end or neck A^3 , and an outlet-pipe end or neck A^4 . The casing or shell A^2 consists of a rim or annulus a and two head or
80 end plates a^2 , the latter being secured to the rim or annulus by bolts a^3 . Each head or end plate is provided with a central opening a^4 of a size to accommodate the inner portions of the two neck or pipe ends A^3 and A^4 , each of
85 these pipe ends being provided with a circumferential flange a^5 to engage with the wall of the opening a^4 to guide the necks. Each neck has at its outer end a flange a^6 , to which is bolted a collar a^7 , these collars being inter-
90 riorly screw-threaded for the reception of the inner end of the section of pipe B. Bolted to the inner face of the inlet-pipe end is a guard or guide A^5 , the same comprising an annulus provided in its upper half with
95 steam-escape openings a^8 . This guard projects to or past the opposing face of the outlet-pipe ends, so that a continuous passage is formed through the variator, thus to prevent water from accumulating in large quantities
100 in the variator-casing, while the steam-escape openings a^8 will permit a steady escape of steam to take place within the interior of the variator-casing, thus to keep the whole line under an equal temperature and pressure and
105 to provide for tapping off the steam. The opposed faces of the two necks or pipe ends are each provided with an incut a^9 , as is also the flange or rim of the guard A^5 on the exterior of the pipe ends, an annulus a^{10} being bolted to the
110 face of the outlet-pipe ends and being similarly incut, so that on the outer portion of both the inlet and outlet pipe ends there will be an exterior circumferential groove a^{11} . The casing A^2 is provided with two similar
115 internal circumferential grooves a^{12} .

Securely bolted between the neck and guard or guide A^5 of the inlet-pipe ends and the neck and annulus a^{10} of the outlet-pipe ends is a diaphragm A^6 , preferably a corrugated
120 copper annular disk, the periphery of these diaphragms being likewise bolted between the annulus a and the head or end plates a^2 , the grooves a^{11} and a^{12} constituting a housing for the two ends of the backing-plates A^7 . As
125 shown in Fig. 10, the ends of these plates A^7 are each provided with an outward-extending toe or flange a^{13} , constituting fulcrums or bearing-points for working against the opposing walls of the respective grooves in which they
130

are mounted. The two sets of plates (it being understood that there is a set on each side of the diaphragm) are provided with strengthening-ribs a^{14} , the ribs on the plates on the outer side of the diaphragm being heavier than those on the inner side, for the reason that the former plates are subjected to the greatest strain. These plates, as shown in Fig. 7, are approximately keystone-shaped in elevation, so that when set up in position the meeting edges will closely abut and radiate from a common center, and thereby present a practically unbroken wall to the steam. It is to be understood that the assemblage of the plates with relation to the two grooves is to be such that while any displacement will be entirely obviated free movement for the purpose desired will always be permitted.

In the inner portion of the casing and on each side thereof there is provided an outlet a^{15} , each of which, as will be seen, is threaded internally to permit a pipe being tapped therein, this pipe serving to carry off steam or water of condensation that might accumulate in the casing and be injurious to the diaphragms, or the pipes may connect with hot-water heaters or supply steam for power purposes or may lead back to the boilers.

To strengthen the casing A^2 , a spider a^{16} (clearly shown in Fig. 12) is or may be employed, this being by preference cast integral with the casing, although it may be made of a separate piece of metal secured to the casing, and is provided with an opening of a size to permit the guard A^5 to project there-through.

When the mains for conveying steam are laid in the streets, they are to be suitably incased in masonry to protect them from damage and also to prevent loss of heat by radiation. At intervals in the mains where the variators occur there will be a construction of suitable masonry and an inclosing box A^8 , of iron, in which the variators will be housed, and the casings or shells A^2 will at these points be anchored against movement. The variators are anchored, as shown in Fig. 11 at A^9 , this anchorage to consist of any suitable material, preferably masonry, and in the event that steam should be admitted to the pipes before the masonry is thoroughly hardened an additional anchorage A^{17} may be employed. In all essential respects when a line is completed it will appear substantially as shown in Fig. 11.

When the parts of the variators are assembled for use, the diaphragms are set out of plumb to a degree practically equivalent to the full contraction the pipe will ever make under the lowest degree of cold, so that when the pipe is subjected to the highest degree of heat and the pipes being extended to their fullest extent the diaphragms will then be practically plumb.

While I have shown herein a variator with two diaphragms, constituting a "double" variator, I may employ but one diaphragm, and thus present a "single" variator.

It is to be understood that this invention is not to be limited to a pipe-line for conveying steam, as it may be employed for carrying any fluid or gas desired.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A variator comprising a casing, an inlet-pipe end and an outlet-pipe end, diaphragms confined between the casings and the two pipe ends, and plates arranged on both sides of each diaphragm, with their inner ends engaging, respectively, the said pipe ends, to constitute guiding-supports for the latter, substantially as described.

2. A variator comprising a casing, an inlet-pipe end and an outlet-pipe end, diaphragms confined between the casings and the two pipe ends, and radially-reinforced plates arranged on both sides of each diaphragm, with their inner ends engaging, respectively, the said pipe ends, to constitute guiding-supports for the latter, substantially as described.

3. A variator comprising a casing, an inlet-pipe end and an outlet-pipe end, diaphragms confined between said casing and the two pipe ends, plates arranged on both sides of each diaphragm, said plates arranged in supporting engagement with said pipe ends, and constructed to permit reciprocation of the latter, flanges upon the outer portion of the casing, and shields secured to said flanges and formed to inclose said pipe ends, substantially as described.

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

WALLACE C. ANDREWS.

Witnesses:

B. P. SEADLER,
GEO. M. HAAS.