

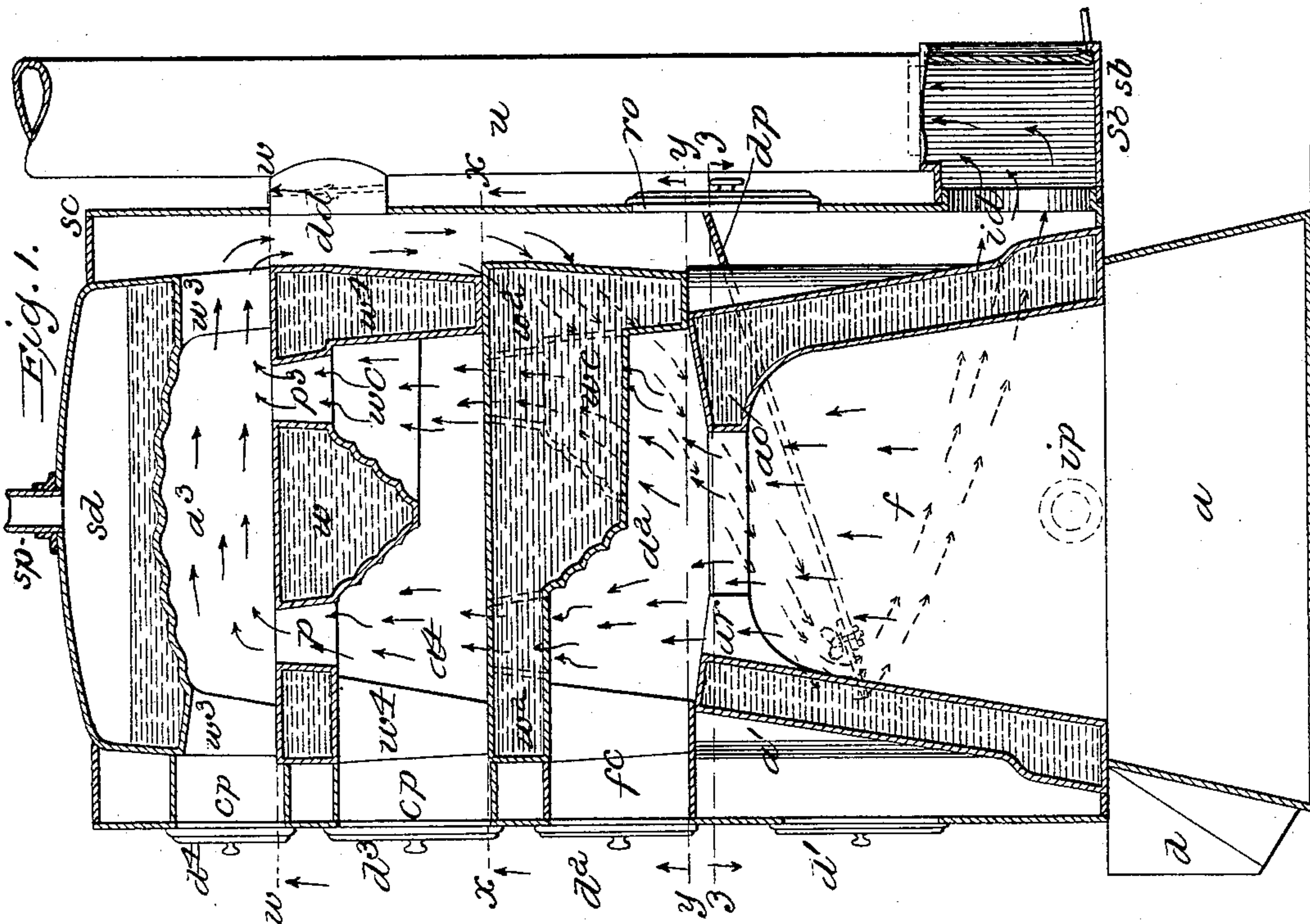
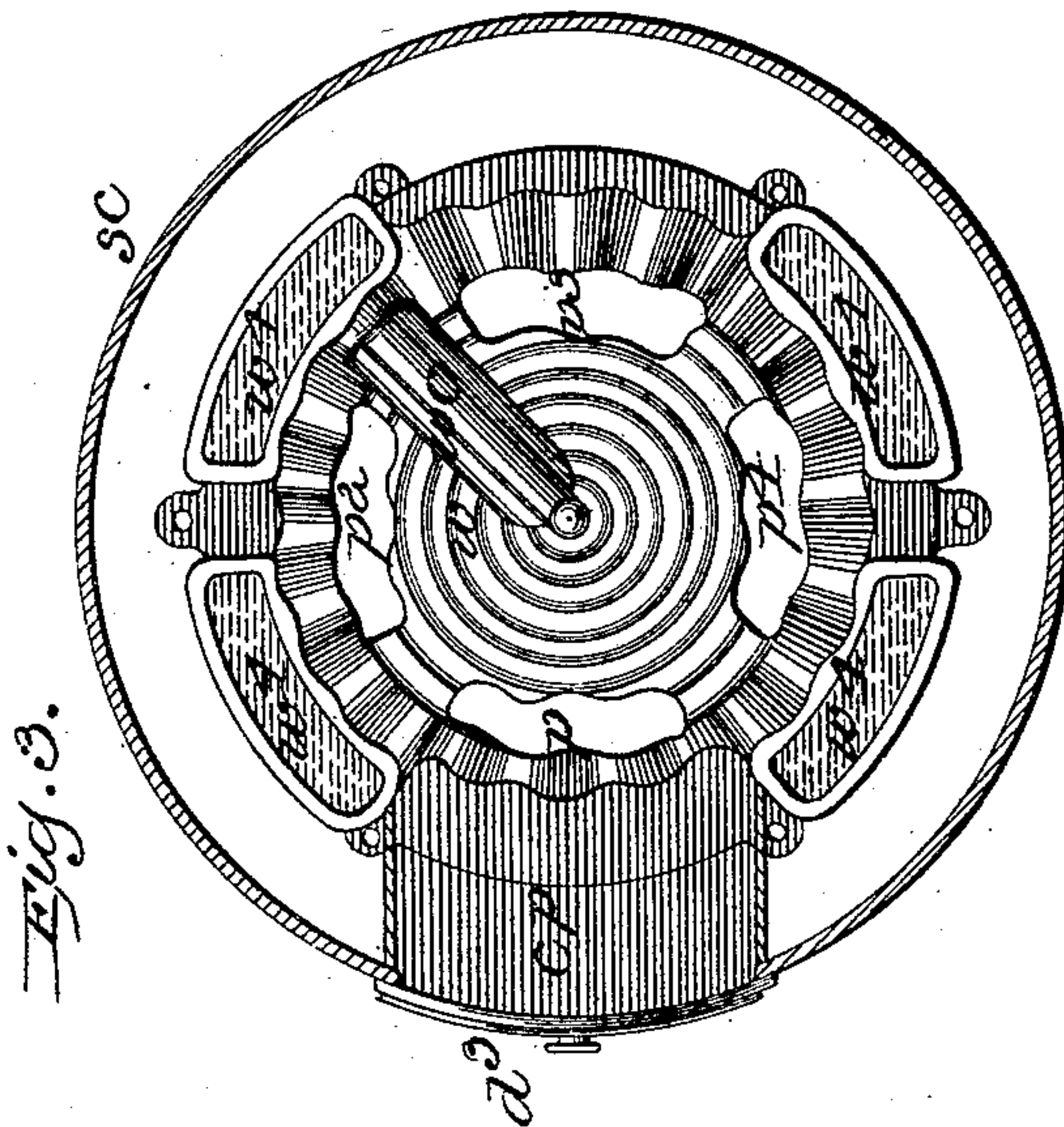
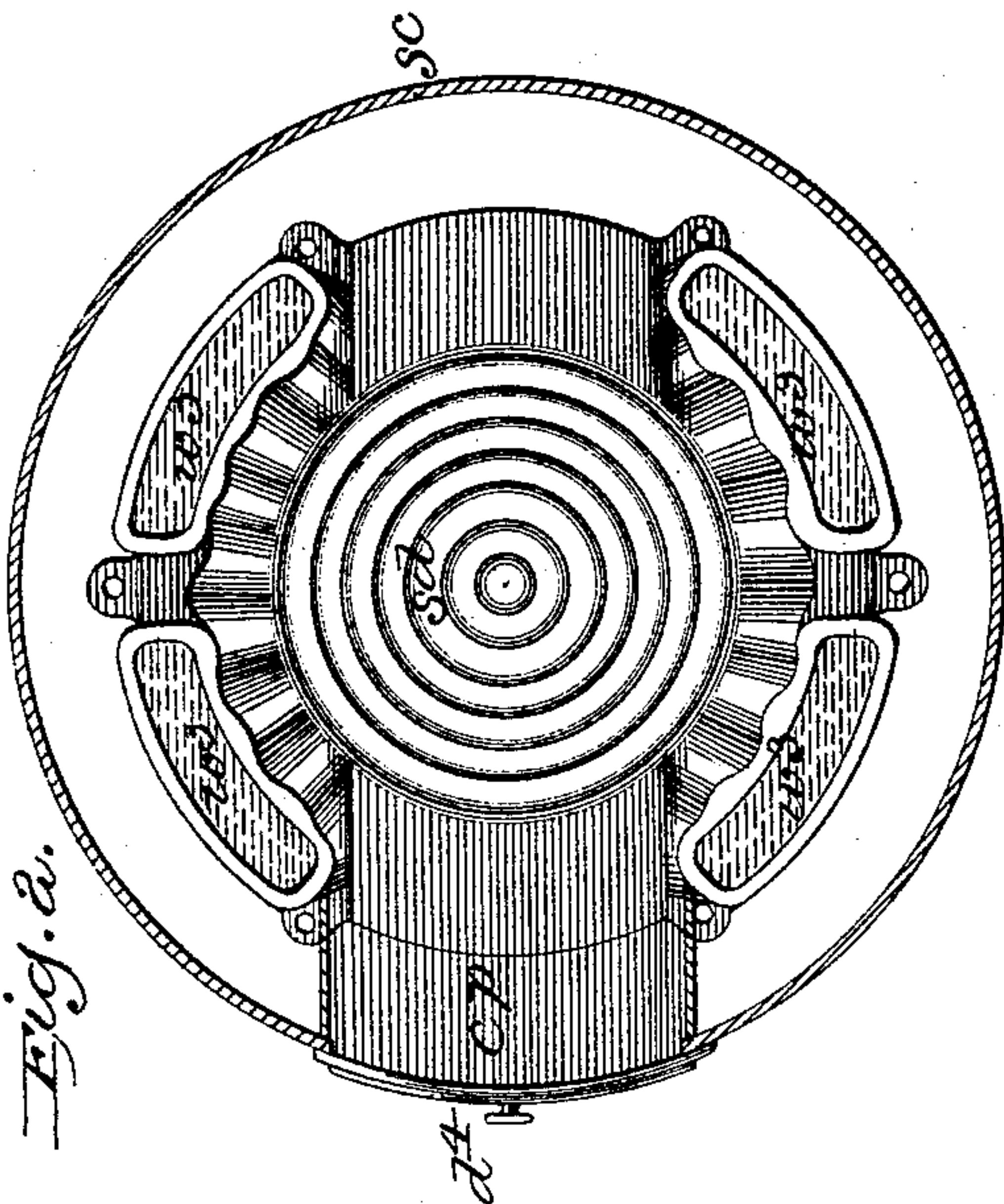
(No Model.)

3 Sheets—Sheet 1.

D. S. RICHARDSON.
SECTIONAL STEAM BOILER.

No. 487,774.

Patented Dec. 13, 1892.



Witnesses:

Arthur Ashley
James F. Duhamel

Inventor:

Dwight S. Richardson

By *A. Ashley atty.*

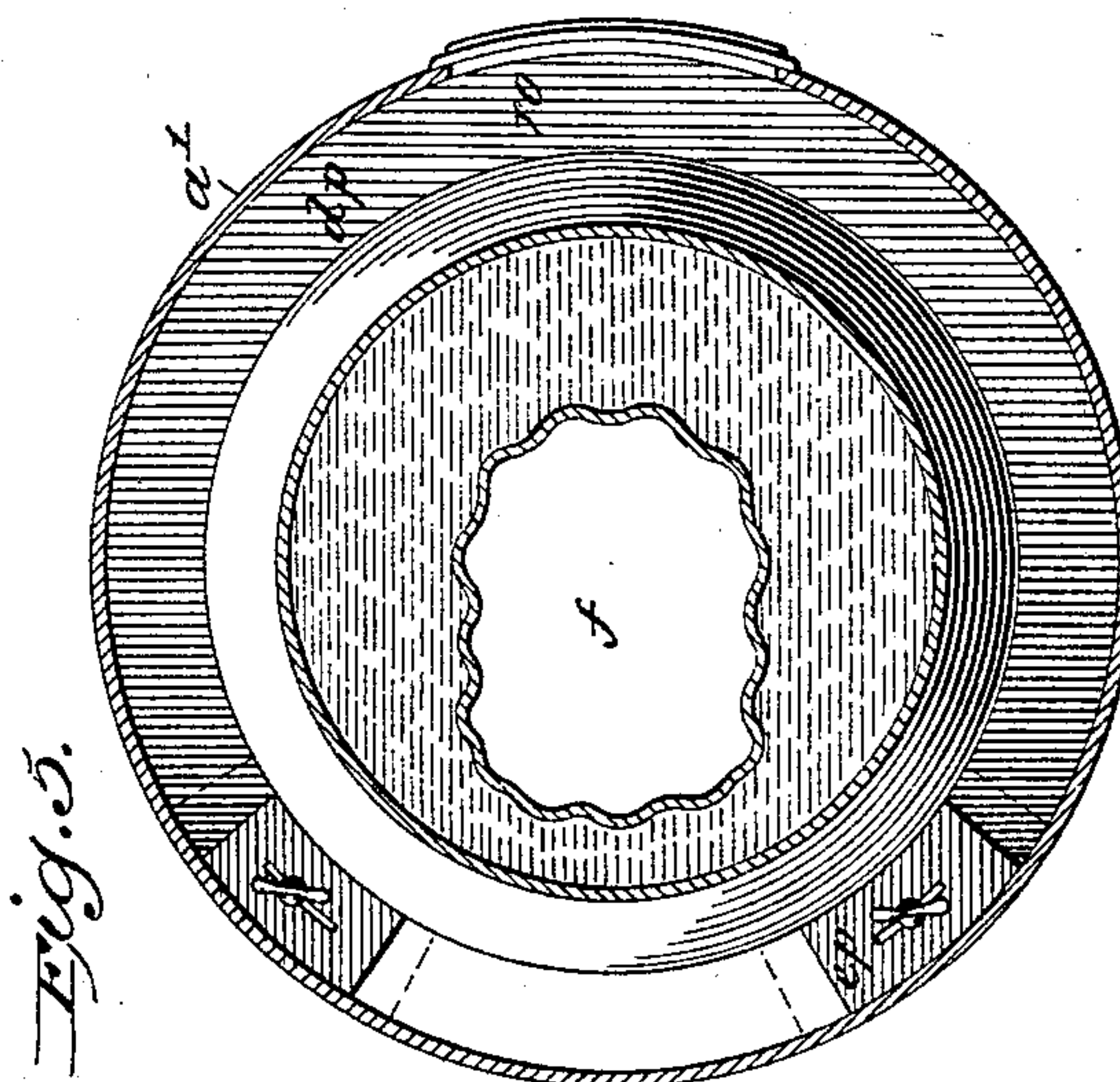
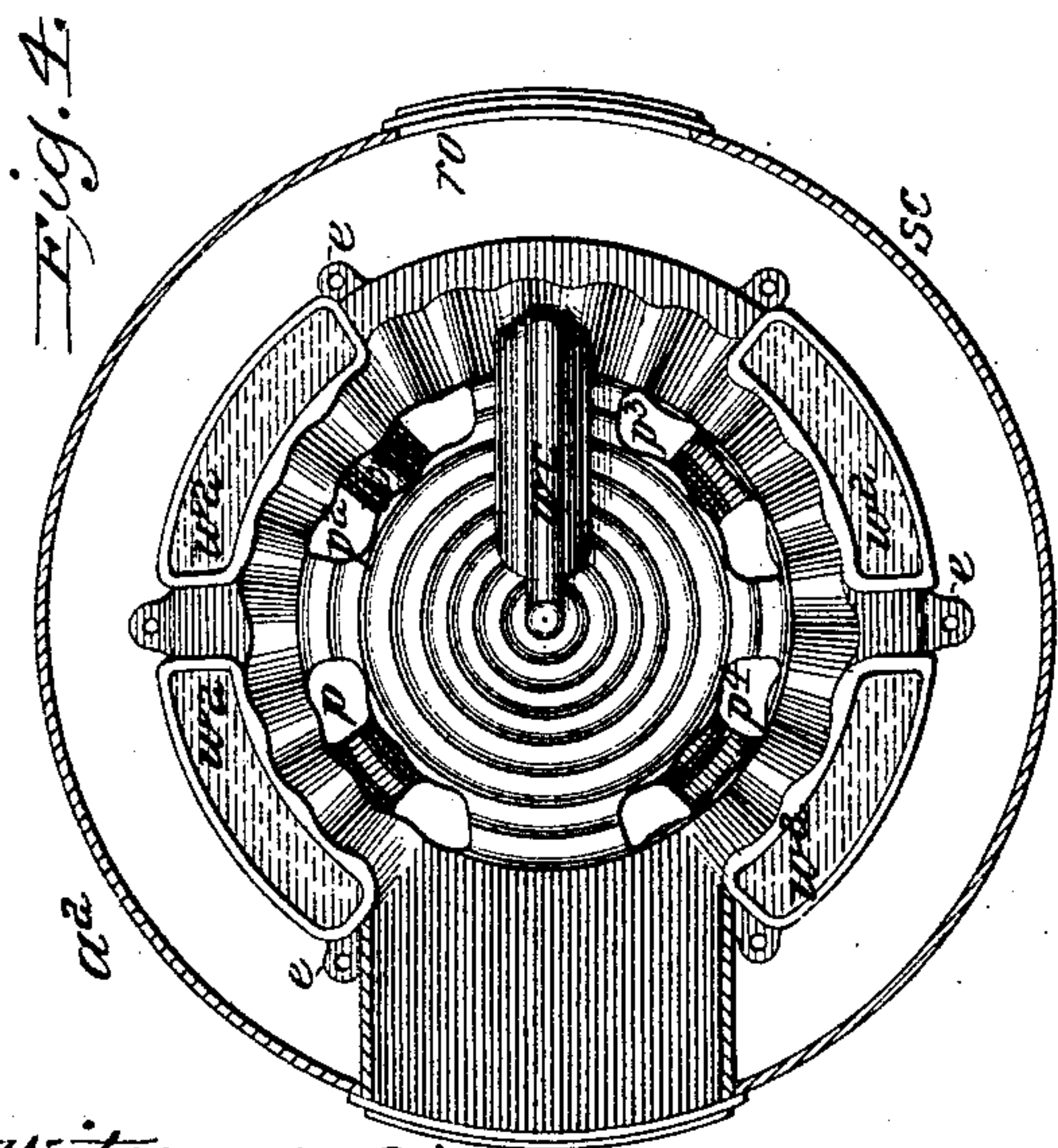
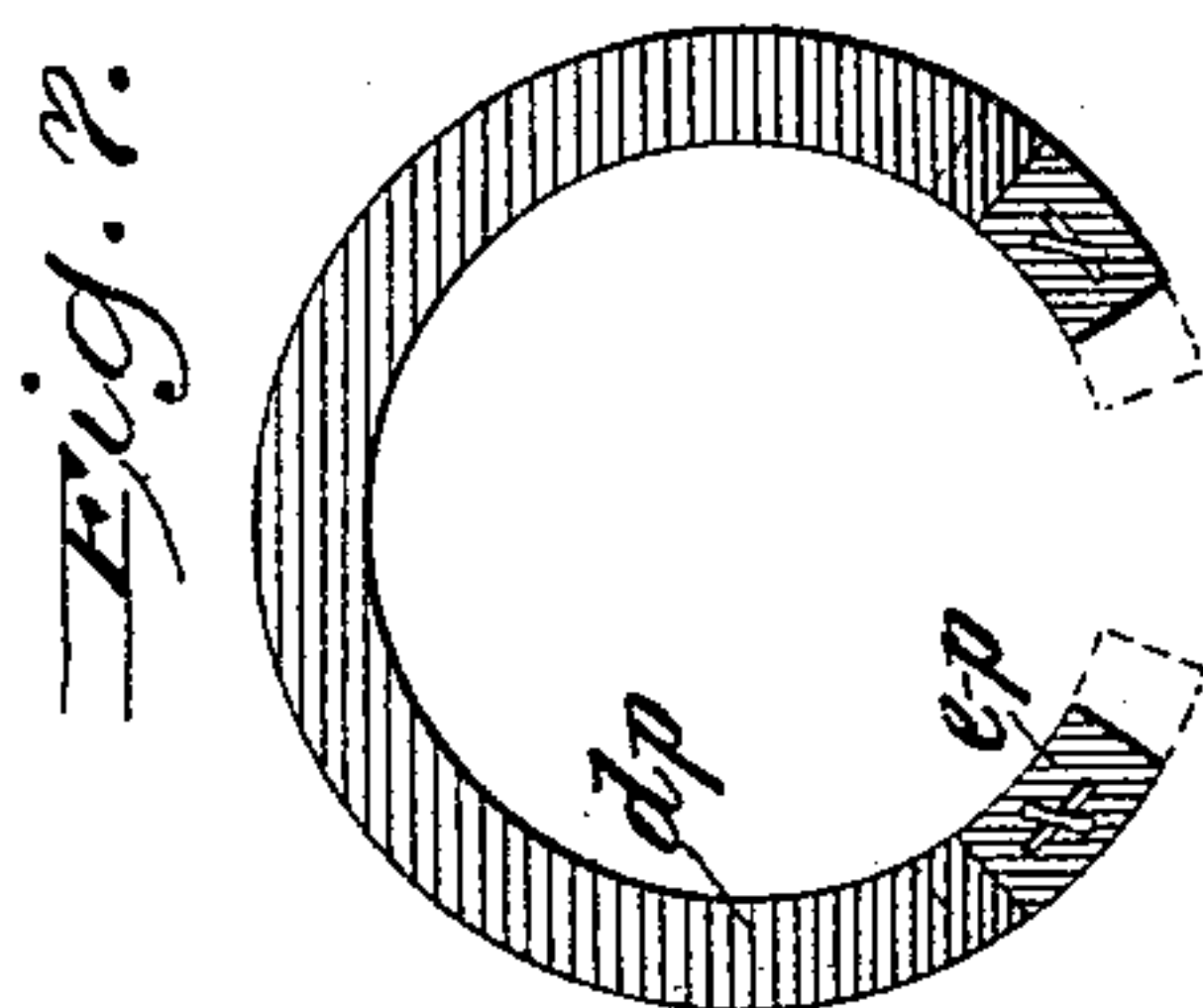
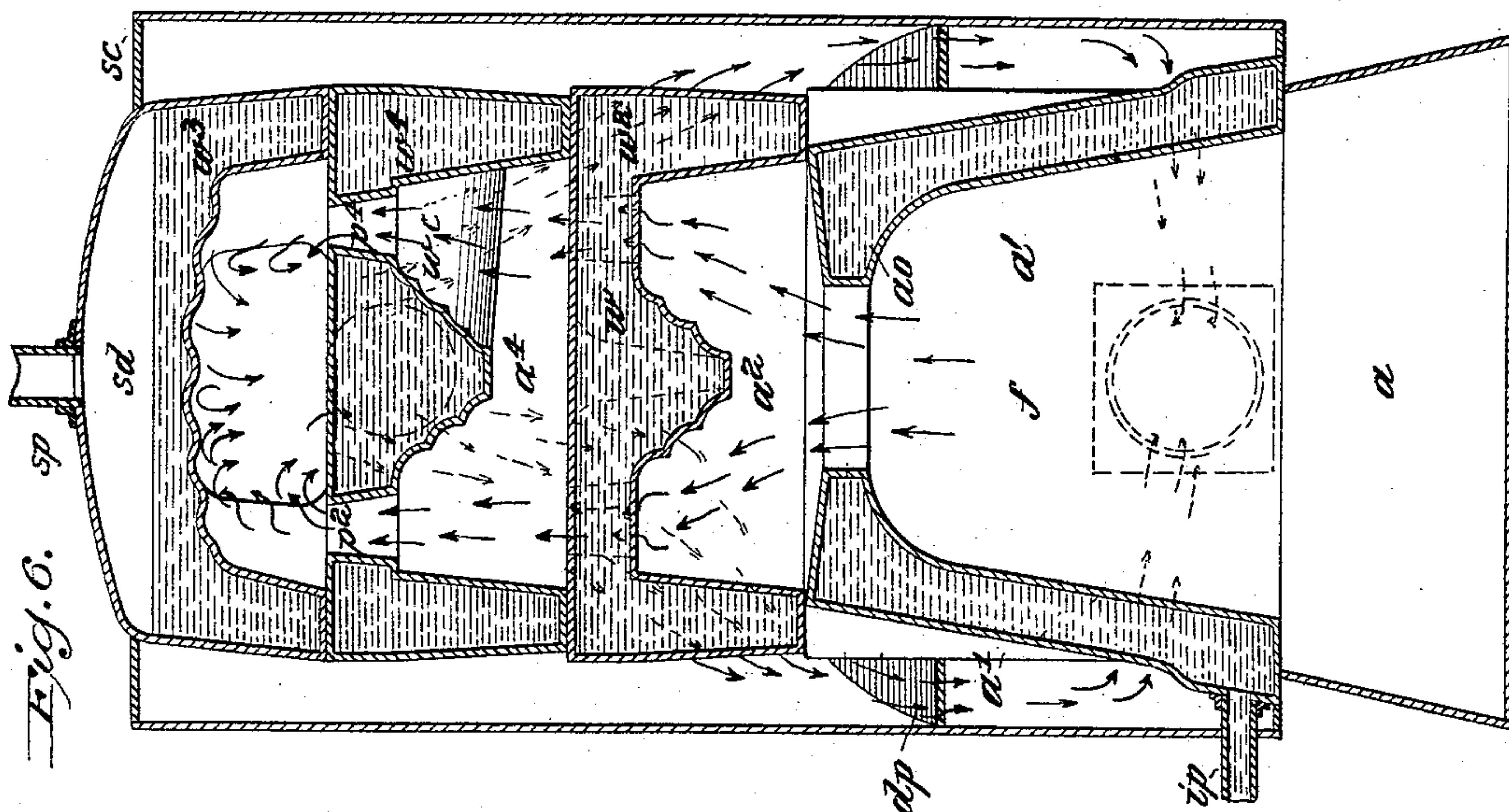
(No Model.)

3 Sheets—Sheet 2.

D. S. RICHARDSON.
SECTIONAL STEAM BOILER.

No. 487,774.

Patented Dec. 13, 1892.



Witnesses:
Arthur Ashbery ^{ad.}
James F. Duhamel.

Inventor
Dwight S. Richardson
By *[Signature]* atty.

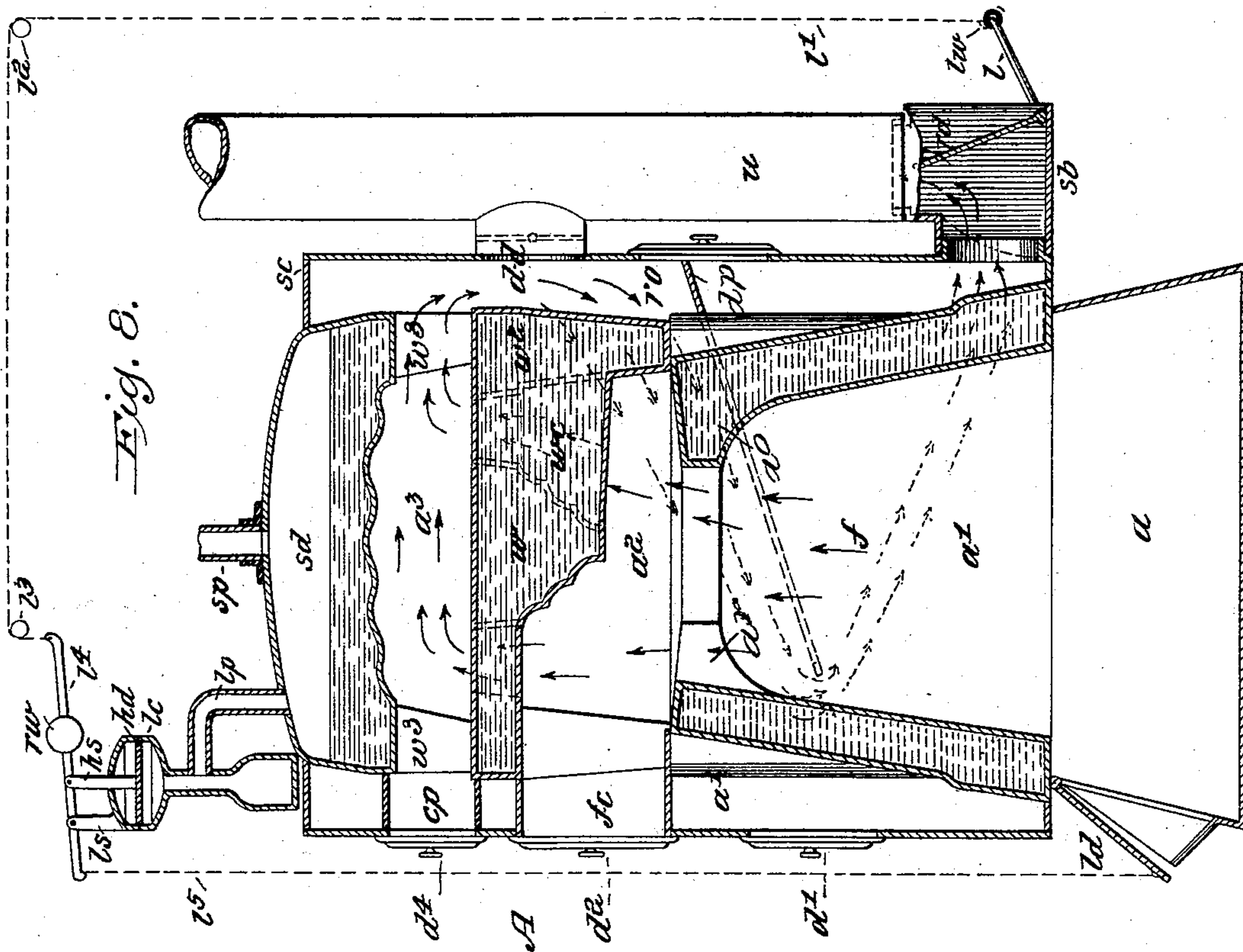
(No Model.)

3 Sheets—Sheet 3.

D. S. RICHARDSON.
SECTIONAL STEAM BOILER.

No. 487,774.

Patented Dec. 13, 1892.



Witnesses:
Arthur C. C. C.
James F. Duhamel

Inventor
Dwight S. Richardson
By J. H. Meyers

UNITED STATES PATENT OFFICE.

DWIGHT S. RICHARDSON, OF BROOKLYN, NEW YORK.

SECTIONAL STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 487,774, dated December 13, 1892.

Application filed March 11, 1892. Serial No. 424,575. (No model.)

To all whom it may concern:

Be it known that I, DWIGHT S. RICHARDSON, a citizen of the United States, and a resident of the city of Brooklyn, in the county of Kings, in the State of New York, have invented a new and useful Sectional Steam-Boiler, of which the following is a correct description.

The invention relates to a sectional boiler of the type most commonly employed for elevating the temperature of the atmosphere of dwellings or other structures, but which may, if desired, be employed in generating steam for power as well.

The object of the invention is the production of a steam-boiler in which the valuable properties of the products of combustion shall be thoroughly utilized, in which the currents of smoke and the currents of water and steam shall be intimately associated, and in which all the parts, whether exterior or interior, shall be readily accessible for observation, supply, regulation, and clearance.

The invention consists in a steam-boiler of the novel construction and embracing the novel parts, improvements, and combinations of parts, which will first be particularly described and then specifically and distinctly claimed.

In the accompanying drawings, which constitute a part of this specification, Figure 1 represents a longitudinal vertical central section of the steam-boiler. Fig. 2 represents a horizontal transverse section in the line $w w$ in Fig. 1, looking upward toward the bottom of the section. Fig. 3 represents a horizontal section taken in the line $x x$ in Fig. 1, looking upward toward the bottom of the section. Fig. 4 represents a view in horizontal section, as in the line $y y$ in Fig. 1, looking upward toward the bottom of the section. Fig. 5 represents a top plan view of the lower portion of the steam-boiler, as seen when looking down from the plane indicated by the line $Z Z$ in Fig. 1. Fig. 6 represents the steam-boiler as seen in vertical transverse section, the section being in a plane perpendicular to the plane of section of Fig. 1. Fig. 7 represents a top plan view of the smoke-diaphragm or encircling flue-plate detached. Fig. 8 represents a vertical longitudinal central section of the steam-boiler slightly modified, as when three only instead of four steam and water sections are

employed, and as showing the means whereby the draft in the apparatus is automatically controlled.

As will be clearly seen in Figs. 1, 2, and 8 of the drawings, the apparatus A may consist either of three or of four horizontal water-sections superposed in order as shown, the whole being mounted upon any suitable ash-pit section a .

The double-walled fire-pot or fuel-chamber water-section a' is interiorly upwardly tapered or indrawn from the lower extremity thereof for about three-fourths its vertical extent, above which it is more sharply indrawn to form a preferably-curved overhang ao , which extends over the fuel-space f at all points, except at the front, where it has a cut-away portion or recess ar to permit observation of the interior of this chamber and to facilitate the supply of fuel thereto.

The combustion-chamber and fuel-supply or feed-chute water-section a^2 rests directly upon the fire-pot water-section a' , and its vertical water-ways receive their supply of water from the openings in the upper extremity of the annular water-chamber which is embraced in such fire-pot section. At its front it is provided with a feed-chute fc , which is closed by a door d^2 , and at its center is a downwardly-tapered and preferably vertically-corrugated water-well w , from which at its rear extends a transversely-V-shaped water-way or conduit wc , which discharges into the rear portion of the encircling water-chamber w^2 . Vertically through this section at equidistant intervals are smoke-passages $p p^2 p^3 p^4$, which when four water-sections are employed discharge into the section a^4 , as seen in Figs. 1 and 6, but when three sections only are employed, as in Fig. 8, discharge directly into the upper or closing water-section a^3 .

The water-section a^4 closely resembles the water-section a^2 ; but it differs slightly from it in the arrangement of its water-ways and its smoke-passages, which are given, as it were, a one-eighth turn from their position, as seen in the section a^2 , so that the smoke-openings are non-coincident with or are "staggered" relatively to the corresponding openings in that section, and the V-shaped drainage-conduit extends obliquely instead of directly rear-

ward from the well *w*. At the front an inclosed passage-way or clearing-opening *cp*, closed at its outer extremity by a door *a*³, is provided for access to the interior of the section for removal from the same of accumulations of soot, ashes, or other substances.

The closing steam and water section *a*³, like the water-section *a*⁴, receives its water-supply from the section immediately below it, such supply being conducted through the vertical water-ways *w*³ *w*³ *w*³ *w*³ into the overspreading steam-dome *sd*, and, like the section *a*⁴, it is provided with a clearing-passage *cp* and a closing-door *d*⁴. The water-section *a*⁷ has a water-supply pipe *wp*, and the steam-dome *sd* has a steam-discharge pipe *sp* arranged in the usual manner.

Inclosing the several water-sections thus described, at a suitable distance therefrom, is the smoke-casing *sc*, which has a short pipe *d d* near its upper extremity, which discharges from the smoke-chamber into an uptake *u* a short pipe *id* for indirect draft and an inclosed encircling diaphragm or deflecting-plate *dp*, which extends from the rear in a plane with the upper extremity of the firepot section to a point at about the mid-height and near the front of the same. At the rear (see Fig. 8) at a point coincident with the extensible and contractible deflecting plate or diaphragm *dp* the smoke-casing *sc* may be provided with an opening *ro* for access to such deflecting-plate for clearance of the same. The indirect discharge of the products of combustion is through a rectangular smoke-box *sb*, in which is mounted a rectangular damper *rd*, which, in common with an arm or lever *l*, is pivoted in bearings at the rear lower extremity of the box. The arm is at its outer extremity provided with a weight *lw* and a line *l'*, which extends upwardly to a point above the plane of the boiler, is passed over pulleys *l*² and *l*³, and is connected to the rear end of a lever *l*⁴, which is pivoted upon the upper extremity of a standard *ls*, which rises from the top of a small steam-chamber *lc*, which is supplied through a pipe *lp* from the steam-dome *sd*. At its opposite extremity the lever *l*⁴ is connected by a line *l*⁵ with the draft-door *ld* at the entrance at the ash-pit section *a*. Within the steam-chamber *lc* is secured a flexible horizontal diaphragm *hd*, from which rises a central stem *hs*, which, extending upward through and moving freely in an opening in the upper extremity of the steam-dome at a point in rear of the supporting-standard *ls*, is pivoted to the lever *l*⁴, which, as will be seen, carries a horizontally-adjustable regulating-weight *rw*.

Persons skilled in the art will understand from the drawings alone that the volatile products of combustion in their movement to the uptake, whether for direct or indirect exit, are throughout their ascent from the fuel-chamber to the upper extremity of the apparatus wholly inclosed by and are brought

into close contact with the interior of the encircling, overhanging, and intercepting water-section, thereby operating to effectively utilize the heat evolved from the fuel, and thus quickly raise the temperature of the inflowing currents of water to the boiling-point. It will also be observed that when the desired degree of steam-pressure has been reached and the direct-exit opening has been closed the sections will be additionally heated by the envelopment thereof, exteriorly as well as interiorly, by the downward movement of the products of combustion through the diving and encircling flues, the passage being, as will be noted, first directly downward at the rear and then diagonally forward to a point near the front of the apparatus beyond the front extremity of the extensible diaphragm. This construction and operation, as will be obvious insures most thorough utilization of all the valuable properties of the fuel. All the interior surfaces being readily accessible through the several front and rear closing openings, such surfaces are easily freed from accumulation of refuse substances.

Through the provision of the steam-chamber *lc* and the flexible diaphragm therein, the weighted lever, and the other described attachments the inlet draft-currents and the indirect smoke-exit currents are rendered automatic or self-controlling, the weight being movable, in connection with a graduated scale upon the pivoted lever, to vary the pressure of steam at which the door of the inlet draft-opening shall begin to close and at which the damper which controls both the indirect exit-opening and the check-draft opening in the smoke-box shall begin to move to close the former and to open the latter.

The overhang of the walls of the fuel-chamber is of marked advantage in that the impact of the ascending heat-currents is exerted in full force upon this portion of the water-section, and in that the tendency of clinker or slag, which may be produced from inferior fuel, will be to fall away from rather than to adhere to the downwardly-enlarging walls of the chamber. Moreover, the unusual vertical extent of the fuel-chamber obviates necessity for frequent renewal of the fuel-supply, and the combustion therein is, as a consequence, relatively slow.

The provision of the V-shaped lateral conduit, in connection with the central water-well, insures quick circulation of the water-currents from such well to the outer portion of the water-section, and as an incidental result of such circulation insures, also, the prevention of any accumulation of sediment at the bottom of the well.

It will be noted that each water-section is a core-casting formed as an integer, that but few joints are produced, and that each section is directly secured to the section directly above it or directly below it by means of short bolts, which extend through the outwardly-projecting horizontal ears *e*. All the joints

are planed or milled to a smooth plane surface, to which in assembling the sections suitable packing is applied.

It will be understood that for ordinary purposes—that is, for dwellings or other structures of moderate dimensions—the apparatus will embrace but three water-sections, as in Fig. 8. When for any reason greater heating capacity or increased steam-power is required, the apparatus will be composed of four water-sections, as represented in Figs. 1 and 6, in which the fuel-chamber water-section is essentially duplicated.

In situations in which the draft is unusually strong the slidable extension *ep* upon the deflecting plate or diaphragm *dp* will be available for modifying the action of the same, and thereby more effectually utilizing the heat evolved therefrom.

The invention having been thus described, what is claimed is—

1. A sectional steam-boiler which embraces an independent base or ash-pit section, a smoke-casing, and a fire-pot or fuel-chamber water-section upon the ash-pit section, a feed-chute water-section upon the fire-pot or fuel-chamber water-section, and a steam-dome or closing-section above the feed-chute water-section, the upper and lower water-sections being connected by vertical smoke-passages which extend through the intermediate water-section and by vertical water-passages which also are provided in such intermediate water-section, each of the water-sections being composed of a single piece, substantially as set forth.

2. A sectional steam-boiler which embraces an independent base or ash-pit section, a fire-pot water-section, and a smoke-casing which rests upon the base or ash-pit section, the fire-pot section being interiorly indrawn from its base to a point below the upper section thereof and provided at its top with an overhang which has a recess or cut-away portion at its front, a feed-chute water-section which is supported upon the fuel-chamber water-section and which has vertical water-passages and vertical smoke-passages, and a steam-dome water-section at the upper extremity of the apparatus provided at its rear with a smoke-discharge opening and at its front with a closable clearing-opening.

3. A sectional steam-boiler in which are combined an independent base or ash-pit section, a double-walled fire-pot water-section which interiorly is in its main portion upwardly tapered or indrawn, which at its upper extremity is upwardly and inwardly curved, and which at its front has a recess or cut-out portion, a combustion-chamber water-section which has a central downwardly-indrawn water-well, around which are vertical smoke-passages, a covering or steam-dome section above the combustion-chamber water-section, and a smoke-casing or inclosing jacket which encircles the several water-sections.

4. A sectional steam-boiler in which are combined an independent base or ash-pit section, a fire-pot water-section which rests upon the base or ash-pit section, a feed-chute water-section which rests upon the fire-pot water-section which has peripheral water-chambers, a central downwardly-tapered water-well and intermediate equidistant concentric vertical smoke-passages, a water-section which rests upon the feed-chute water-section which has peripheral vertical water chambers or passages, a central depending water-well and intermediate equidistant concentric vertical smoke-passages which are non-coincident with the smoke-passages in the feed-chute water-section, a covering or steam-dome water-section which rests upon the water-section which is directly supported by the feed-chute water-section, a smoke-casing which incloses the several described superposed water-sections and forms therewith an intermediate diving-flue, and a partially-encircling downwardly and forwardly inclined diaphragm or flue-plate between the smoke-casing and the series of water-sections, which operates to deflect the escaping products of combustion and cause them to pass from the rear of the apparatus to a point near the front of the same before passing to the point of exit at the base and rear of the smoke-casing.

5. In a sectional steam-boiler, a horizontal water-section which has peripheral water-spaces, a central water-well, and a transversely-extending water-passage which at one side extends from the water-well to a peripheral water-space, and smoke-passages which are arranged at intervals around the water-well and extend vertically through such water-sections.

6. In a sectional steam-boiler, a water-section which has upwardly and inwardly inclined walls which inclose and overhang the fuel-space and which at its front and upper extremity has a recess or cut-away portion, combined with a fuel-supply section the door of which is coincident with such recess or cut-away portion, whereby observation of the interior of the fuel-chamber and supply of the fuel thereto are facilitated.

7. In a sectional steam-boiler, an exterior smoke-casing, a base or ash-pit section, a fire-pot or fuel-chamber water-section upon the ash-pit section, and two or more horizontal superposed water-sections upon the fuel-chamber section, each of such superposed sections having a horizontal closable passage which extends from the interior of such water-section outwardly to the smoke-casing, in combination, substantially as and for the purposes set forth.

8. A sectional steam-boiler in which are combined an independent base or ash-pit section and a series of superposed horizontal water-sections which inclose the fuel-chamber and the combustion-chamber and which are inclosed by a smoke-casing, whereby in opera-

tion through indirect exit the surfaces of the water-sections are subjected to the action of the heat-currents, first, interiorly as such currents ascend through such sections, and, 5 second, exteriorly, as the currents descend along and around the outer face of such sections and between them and the inner surface of the smoke-casing.

9. A sectional steam-boiler in which are 10 combined an independent base or ash-pit section, an exterior smoke-casing, and a series of superposed horizontal water-sections which together inclose the fuel-chamber and the combustion-chamber and each of which has 15 a lateral passage or way which extends outwardly to the smoke-casing and which is accessible through suitable doors in the same for supply of fuel to the fire-pot or for clearance of accumulations of refuse from the interior of the section. 20

10. A sectional steam-boiler in which are combined an independent base or ash-pit section, a smoke-chamber encircling the sections of the boiler, a water-section upon the ash-pit 25 section which has interiorly an upwardly-indrawn fuel-chamber and which exteriorly is nearly encircled by a deflecting-plate which divides the smoke-chamber into upper and lower forwardly and backwardly extending 30 smoke-flues, a feed-chute water-section upon the fuel-chamber water-section which has a central water-well, a peripheral water-chamber, and a conduit, which for circulation and clearance connects the central water-well 35 with the peripheral water-chamber, and a covering or closing water-section which is open at its front for clearance and which is open at its rear for smoke-discharge, the several lower water-sections having upwardly-dis- 40 charging smoke-passages and water-passages,

and each water-section being cast as an integer, as set forth.

11. In a sectional steam-boiler, an upwardly-indrawn fire-pot or fuel-chamber water-section having top overhang, whereby restricted 45 and concentrated discharge of the volatile products of combustion is produced, and a feed-chute water-section upon the fuel-chamber water-section provided with peripheral water-spaces, vertical smoke-passages, and a 50 central depending water-well which is suspended directly above the contracted discharge-opening of such fire-pot or fuel-chamber water-section, combined for operation substantially as specified. 55

12. In a sectional steam-boiler, an upwardly-indrawn fire-pot or fuel-chamber water-section having interior overhang at its upper extremity, whereby restricted and concentrated 60 discharge of the volatile products of combustion is produced, a feed-chute water-section upon the fuel-chamber water-section provided with peripheral water-spaces with a concentrically-arranged series of vertical smoke- 65 passages and with a central depending water-well which is suspended directly above the contracted discharge-opening of the fire-pot or fuel-chamber water-section, and a closing or steam-dome water-section above the feed-chute water-section, its upper or steam-dome 70 portion embracing the entire horizontal area of the section and receiving the direct impact of the discharge through the concentric series of smoke-passages in the subjacent water-sections, combined for operation sub- 75 stantially as described.

DWIGHT S. RICHARDSON.

Witnesses:

THOMAS H. WARBURTON,
H. C. KAUSKE, Jr.