

No. 708,780.

Patented Sept. 9, 1902.

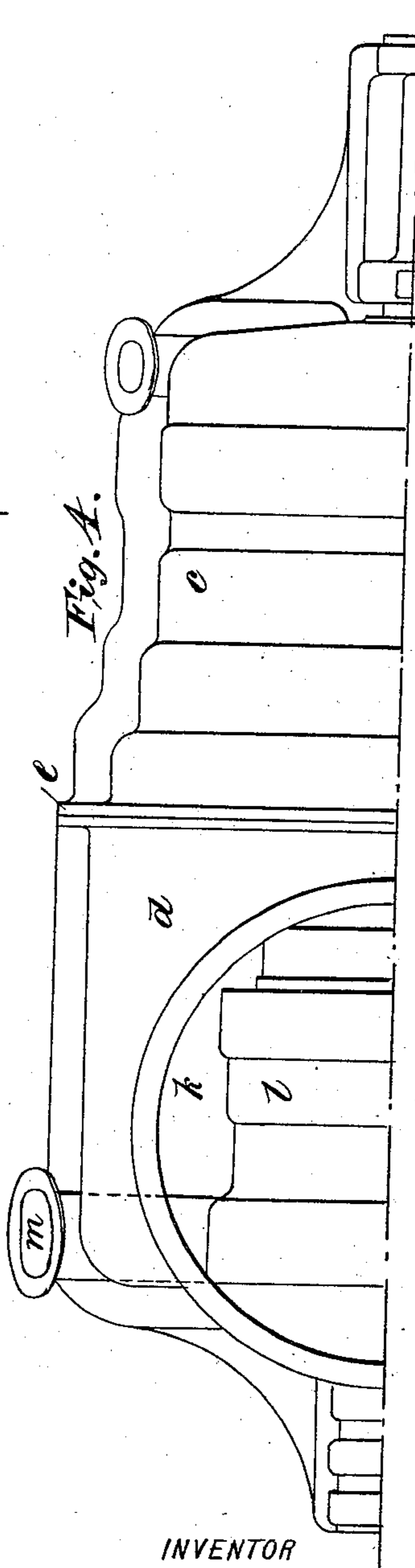
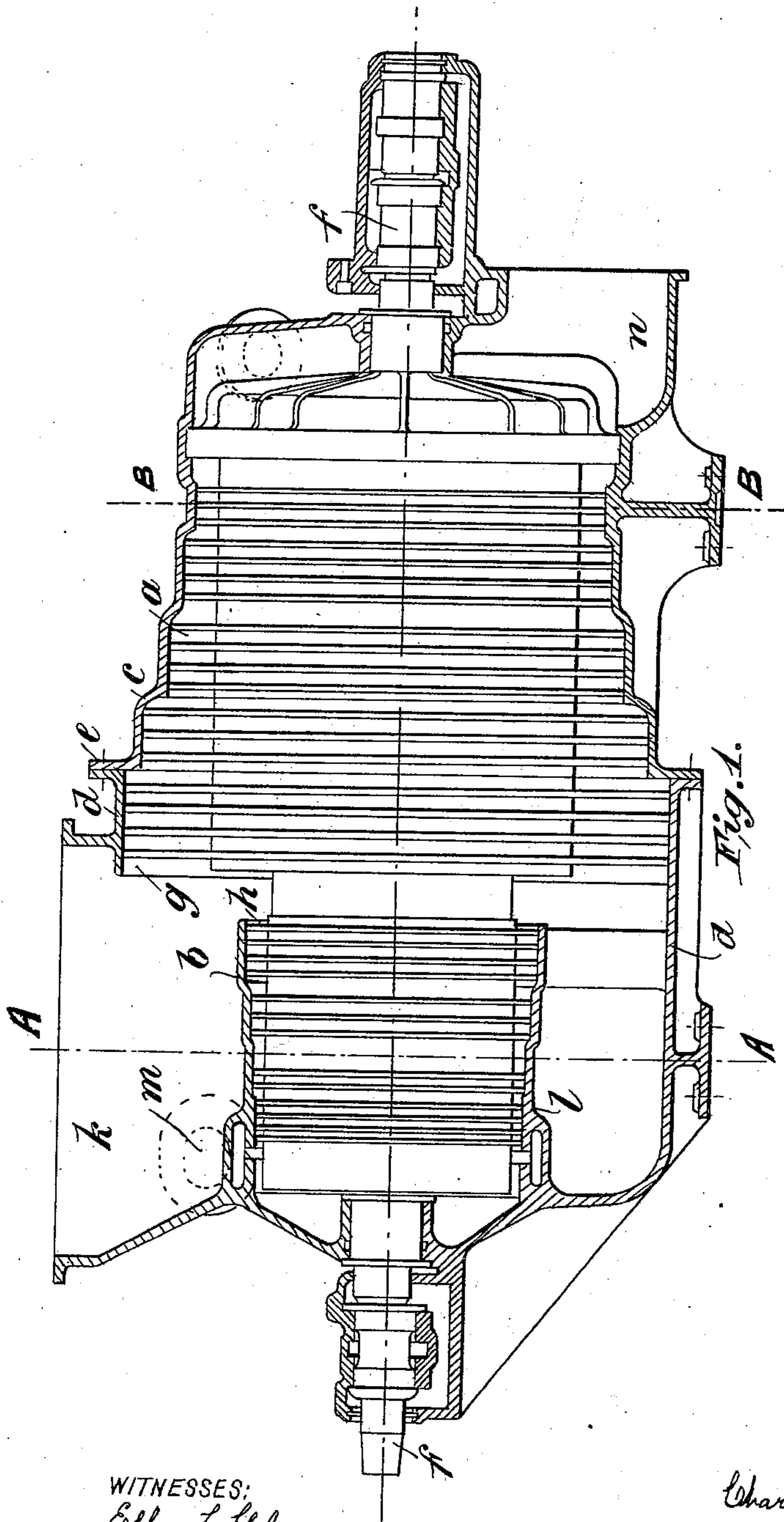
C. A. PARSONS.

STEAM TURBINE.

(Application filed Feb. 13, 1900.)

(No Model.)

5 Sheets—Sheet 1.



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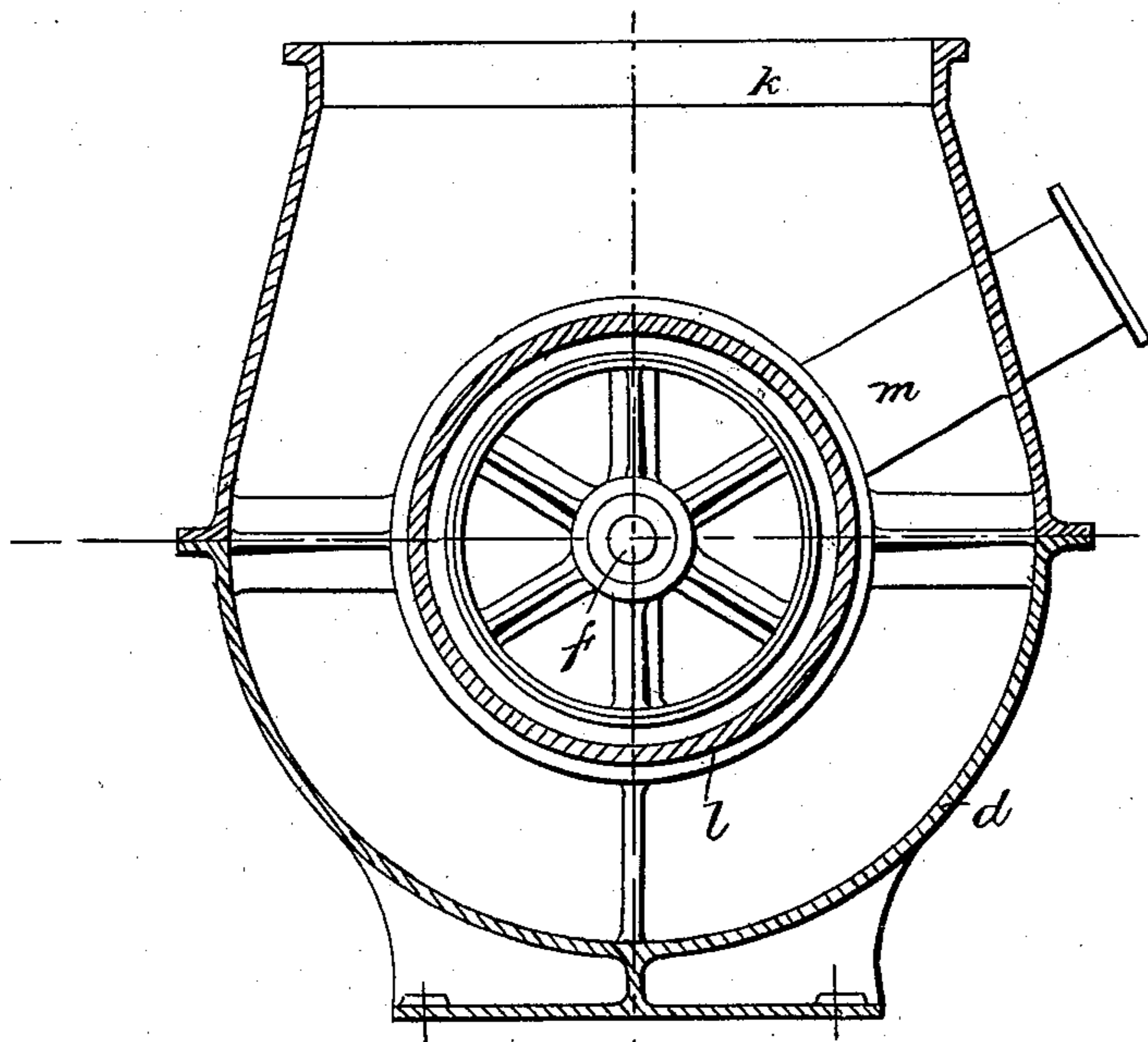


Fig. 2.

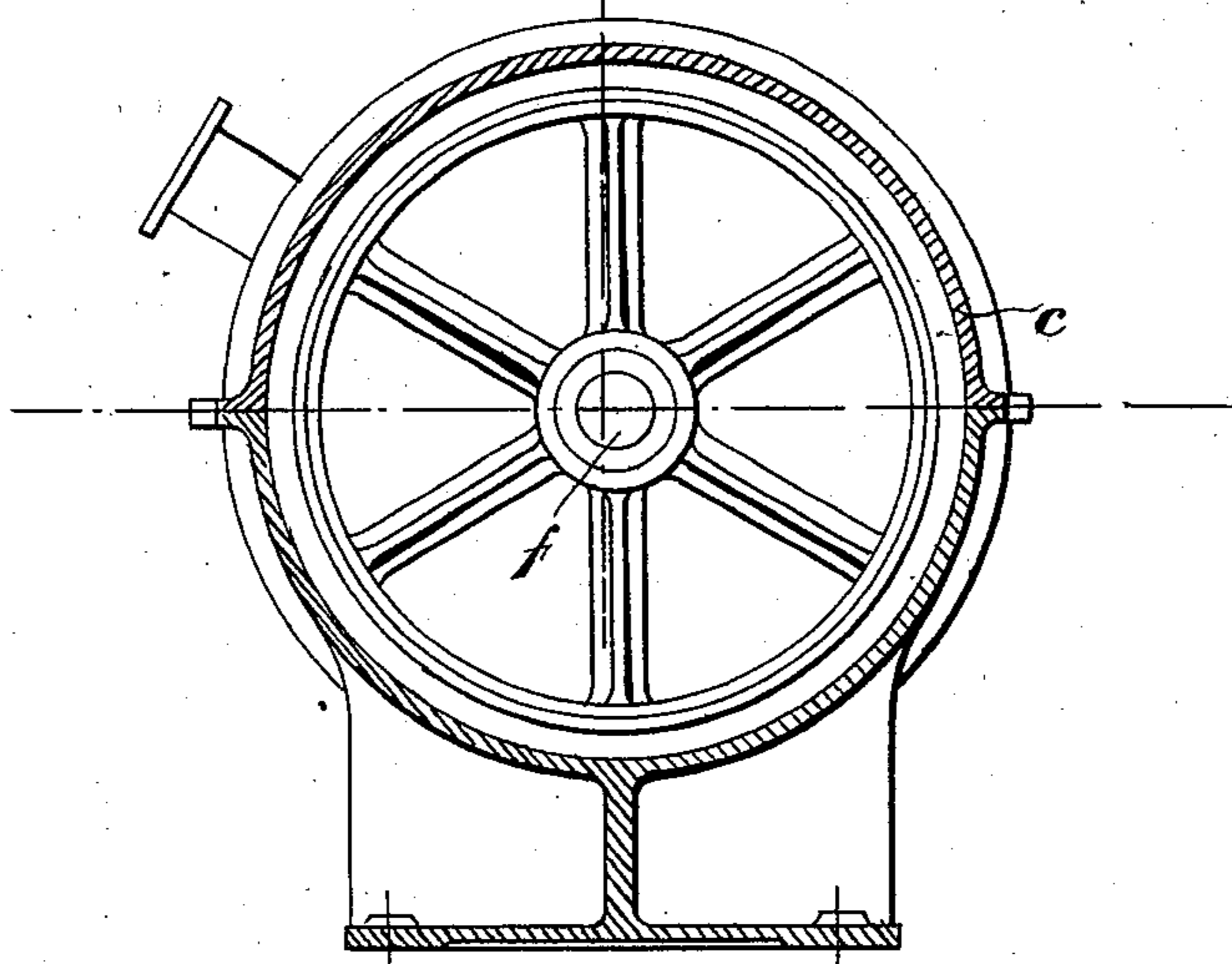


Fig. 3.

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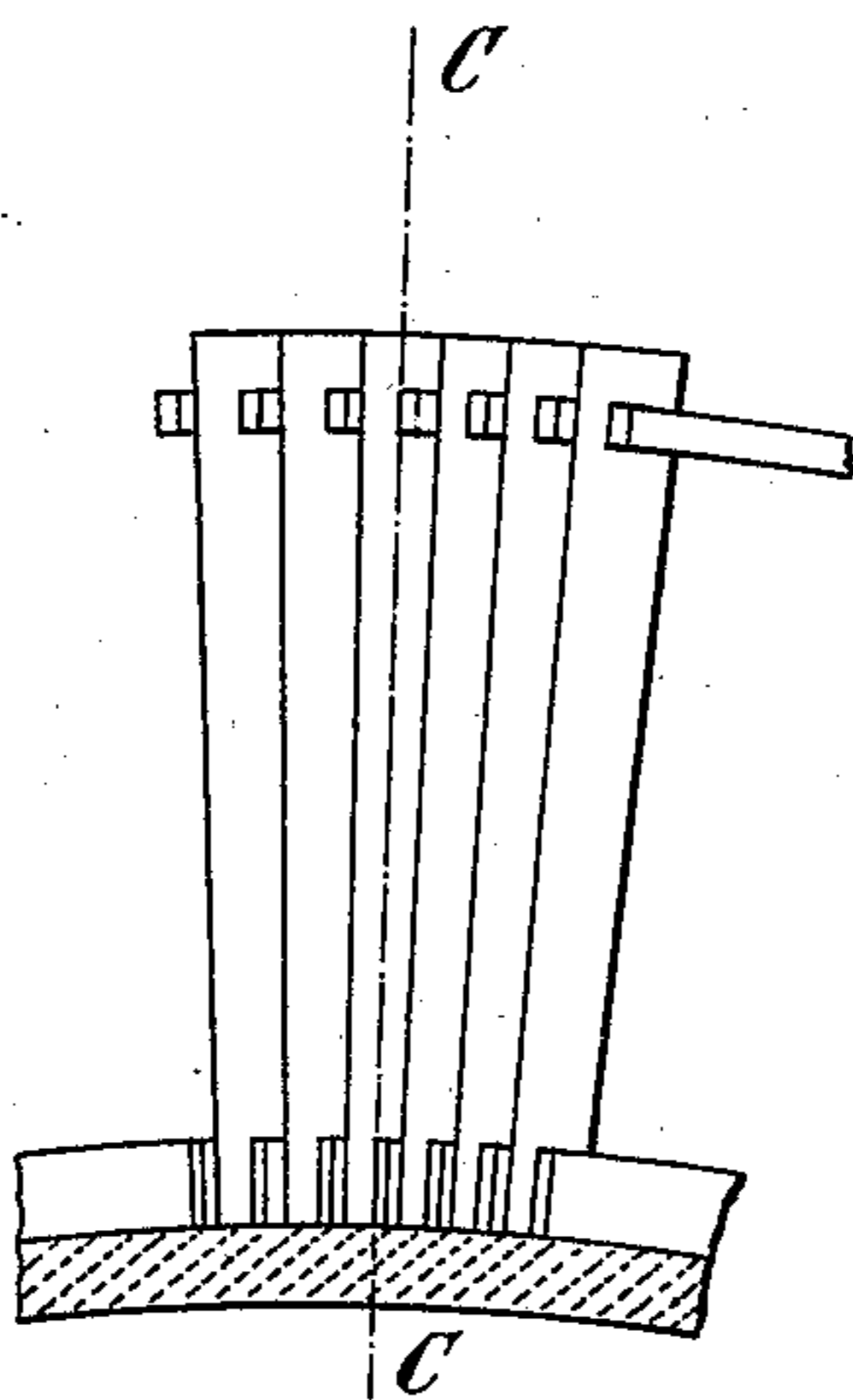


Fig. 4<sup>A</sup>

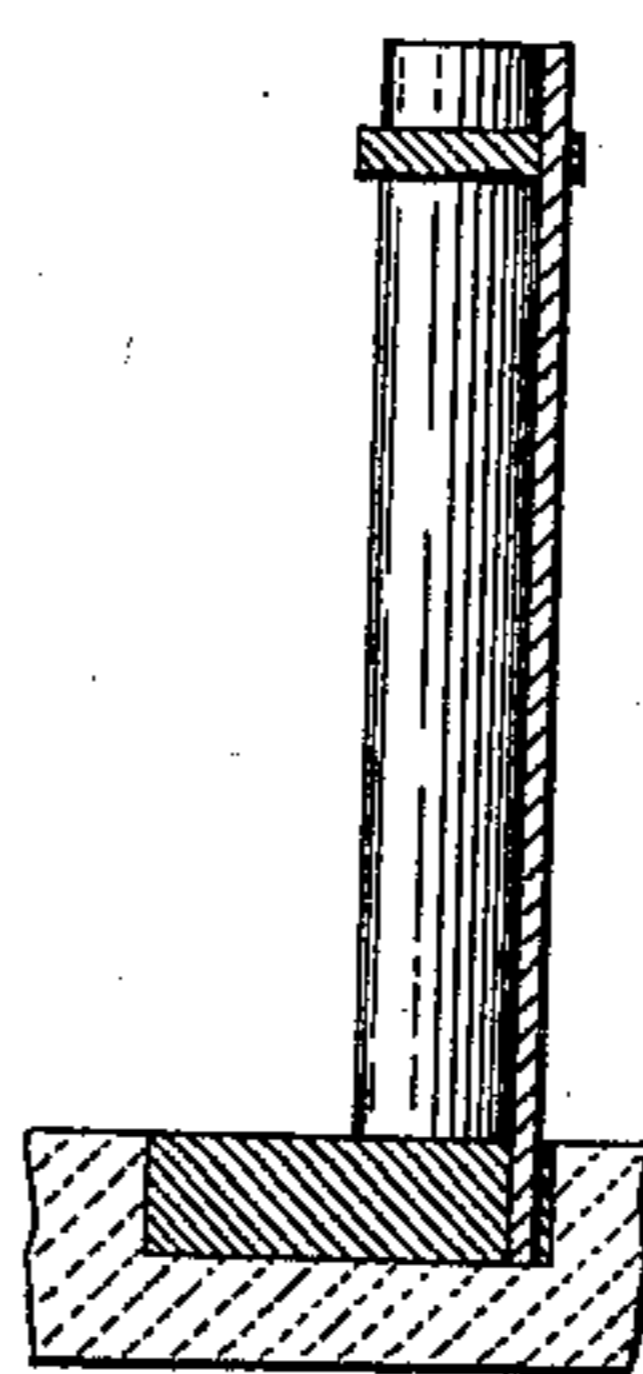


Fig. 4<sup>C</sup>

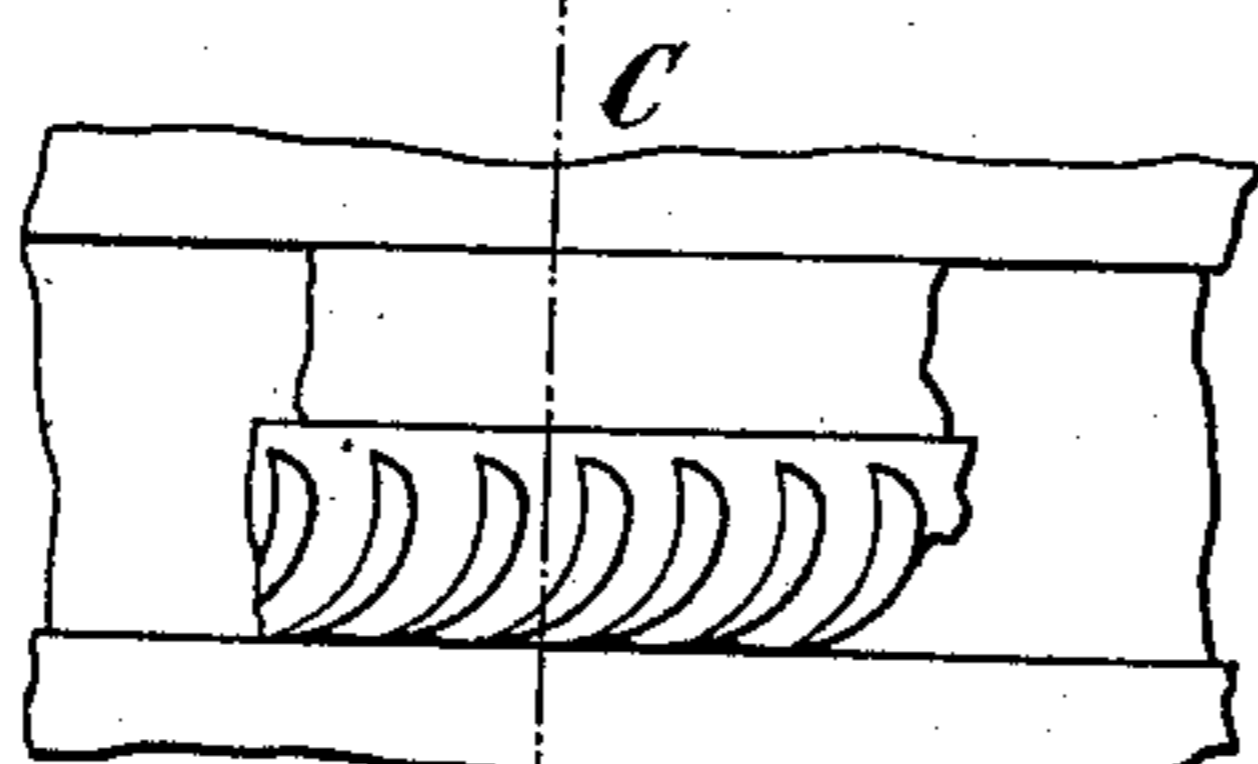


Fig. 4<sup>B</sup>

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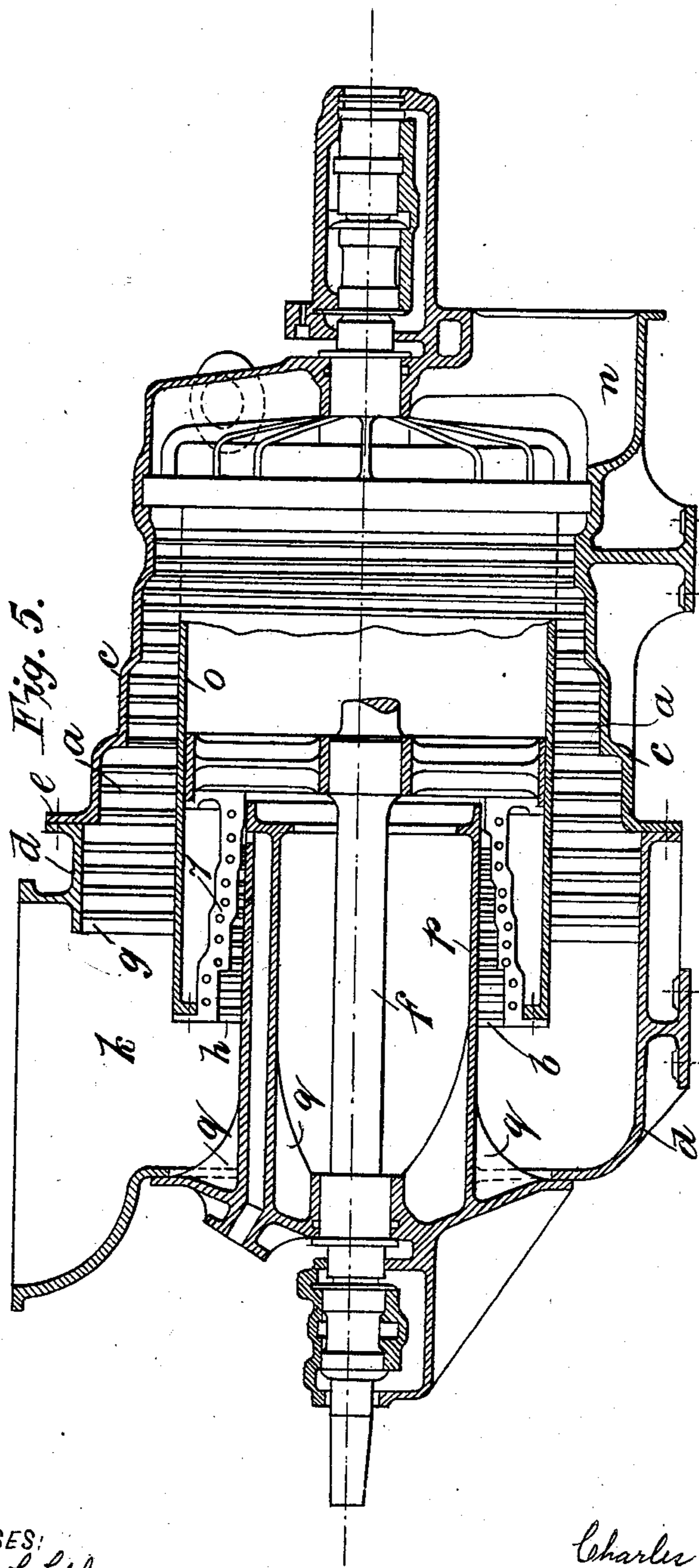
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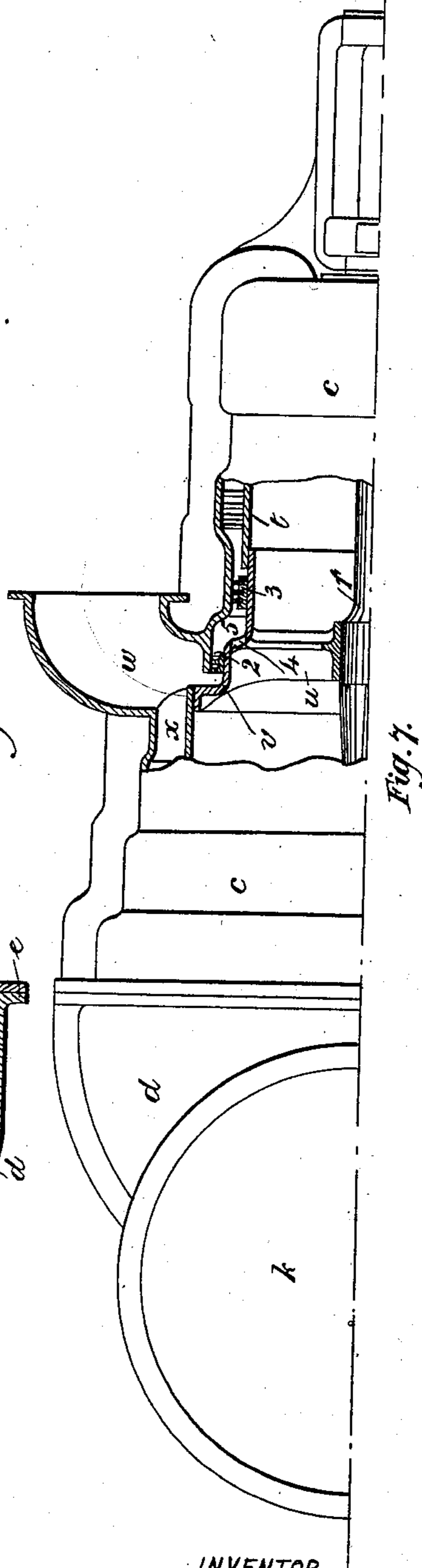
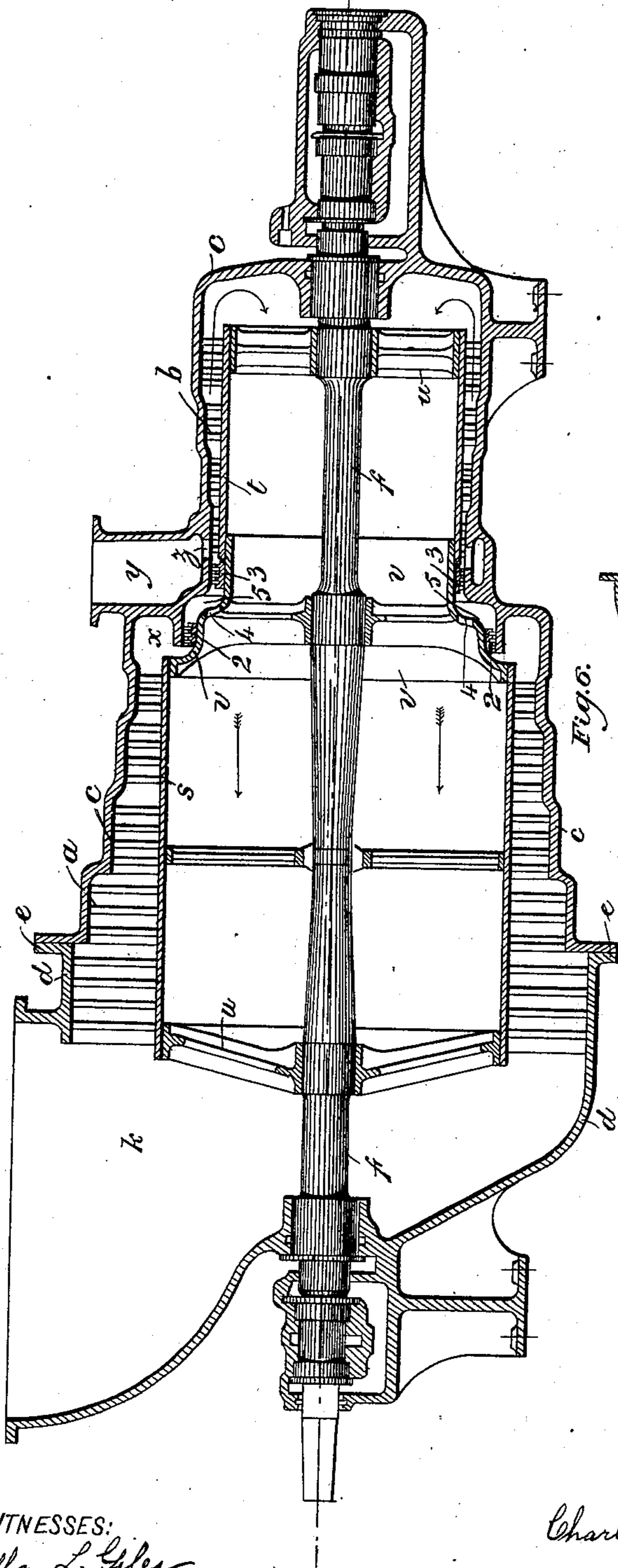
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# UNITED STATES PATENT OFFICE.

CHARLES ALGERNON PARSONS, OF NEWCASTLE-UPON-TYNE, ENGLAND.

## STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 708,780, dated September 9, 1902.

Application filed February 13, 1900. Serial No. 5,080. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES ALGERNON PARSONS, engineer, a subject of the Queen of Great Britain and Ireland, residing at Heaton Works, Newcastle-upon-Tyne, in the county of Northumberland, England, have invented certain new and useful Improvements in Steam-Turbines, (for which I have made application for Letters Patent in Great Britain, No. 14,476, dated July 13, 1899,) of which the following is a specification.

My invention relates to steam-turbines, principally to steam-turbines used for marine propulsion; and its object is to drive the propeller-shaft in a reverse direction with greater power and economy than have been hitherto possible and also to obtain a better and more convenient mechanical construction and arrangement.

My invention comprises a combination of main steam-turbine with reversing steam-turbine in which the main turbine and reversing-turbine are inclosed within a casing formed in one piece or within a casing formed of several pieces bolted together, the exhaust ends of both main and reversing turbines discharging directly into the condenser or into one passage leading to the condenser; a combination in which the reversing-turbine is telescoped within the main turbine in order to reduce the longitudinal space occupied, and the reversing-turbine case preferably then revolves while the center part is fixed, and a combination in which the reversing-turbine is placed at the steam end of the main turbine and the exhaust from the reversing-turbine passes through the interior of the main-turbine spindle or drum. In all these modifications of my invention the reversing-turbine is one of my ordinary types, and it is run in the vacuum of the condenser while the main turbine is in operation.

In the accompanying drawings, which illustrate my invention, Figure 1 is a sectional elevation of a main and a reversing turbine mounted on the same spindle and arranged and constructed according to one modification of my invention. Fig. 2 is a section taken on the line A A of Fig. 1. Fig. 3 is a section taken on the line B B of Fig. 1. Fig. 4 is a half plan of Fig. 1. Figs. 4<sup>A</sup>, 4<sup>B</sup>, and 4<sup>C</sup> show

in detail part of one of the turbine-rings of blades. Fig. 5 is a sectional elevation of a main and a reversing turbine mounted on the same spindle and arranged and constructed according to one form of another modification of my invention. Fig. 6 is a sectional elevation of a main and a reversing turbine mounted on the same spindle and arranged and constructed according to a third modification of my invention. Fig. 7 is a half plan, partly in section, of Fig. 6.

Referring in the first place to Figs. 1, 2, 3, and 4, *a* is the main turbine, inclosed chiefly in the casing *c*, and *b* the reversing-turbine, inclosed in the inner part *l* of the casing *d*, the casings *c* and *d* being bolted together at *e*. The main turbine *a* is of my well-known parallel-flow type and is mounted on the spindle *f*, which also carries the reversing-turbine *b*, which has its low-pressure end *h* turned toward the low-pressure end *g* of the main turbine. Both turbines are formed of fixed and moving rings of blades arranged alternately, the fixed rings being attached to the casings *c*, *d*, and *l*, while the moving rings are connected to the drums 6 and 8, which are mounted on the spindle. These rings are represented diagrammatically by straight lines in Figs. 1, 5, 6, and 7. Fig. 4<sup>A</sup> shows in elevation part of one of the moving rings of either the main or the reversing turbine. Fig. 4<sup>B</sup> is a plan of the same, and Fig. 4<sup>C</sup> is a section of the same on the line C C of Figs. 4<sup>A</sup> and 4<sup>B</sup>. The lower pressure ends of both main and reversing turbines open into the low-pressure casing *d* and discharge by the same passage *k* to the condenser, or the low-pressure casing *d* may be made part of the condenser without special passages. The steam-supply for the main turbine enters by the passage *n*, while I preferably carry the steam-supply to the reversing-turbine through the low-pressure casing *d* by a separate steam-pipe *m*. By this arrangement I produce a powerful reversing-turbine, which rotates in the condenser-vacuum when the main engine is operating the spindle *f* in the usual direction—*e.g.*, for propelling a vessel ahead.

Instead of arranging the vacuum ends together I may turn the reversing-motor around, placing the high-pressure end near the vacu-

um end of the main engine, while still maintaining the separate turbine-casing *l* within the low-pressure casing *d* and discharging from the reversing-turbine into the low-pressure casing, as before, and also running the reversing-turbine in the condenser-vacuum, as before mentioned.

Referring now to Fig. 5, which illustrates one form of the second modification of my invention, the reversing-turbine *b* is here telescoped within the main turbine *a* in order to economize longitudinal space. The spindle *f* carries the drums *o* and *7*, which support the rotating blades of the main and reversing turbines, respectively. The fixed blades of the main turbine are attached, as before, to the outside casings *c* and *d*, and those of the reversing-turbines are fixed on the outside of the inner cylinder *p*, which is preferably supported from the exhaust-casing *d* by projecting arms or webs *q*. Steam is supplied to the reversing-turbine by a pipe or pipes *r* inside or forming part of the inner cylinder *p*. These steam-pipes may serve for fixing the cylinder *p* to the end of the casing *d*. Instead of this arrangement the steam may be conveyed to the reversing-turbine through the spindle *f* from the passage *n*, which supplies steam to the main turbine, as in my previous modification.

Instead of having two drums *o* and *7* I may form or attach the rotary blades of the reversing-turbine on the inside of the drum *o*, the second drum *7* being thus dispensed with.

Referring now to Figs. 6 and 7, which illustrate the third modification of my invention, I arrange the reversing-turbine *b* in this modification with its steam end toward the steam end of the main turbine *a*, and I attach the rotating blades of the main and reversing turbines to the drums *s* and *t*, respectively, these drums being connected to the spindle *f* by arms *u u* and to each other by the connecting-ring *v*. The fixed blades of both turbines are attached to the outside casings *c* and *d*. Steam to the main turbine is admitted by the pipe *w* and passage *x*, Fig. 7, and steam to the reversing-turbine by the pipe *y* and passage *z*, Fig. 6. Exhaust-steam from the main turbine is discharged direct into the low-pressure casing *d* and thence by the passage *k* to the condenser, as in my other modifications; but the exhaust-steam from the reversing-turbine first passes through the drums *t* and *s*, as indicated by the arrows, to reach the casing *d*. To prevent excessive leakage of steam from the steam end of the main turbine to the steam end of the reversing-turbine, or vice versa, I provide at the points 2 and 3 a series of baffle grooves and rings on the casing *c*, alternating with a series of grooves and rings on the ring *v* in order to throttle the steam in a manner introduced by me and now well known. I provide holes 4 in the ring *v* to allow any steam that has leaked past the

baffle-rings into the space 5 to escape to the condenser. I may in this modification reverse the position of the reversing-turbine, placing its exhaust end toward the steam end of the main turbine and in communication with the space 5. The exhaust from the reversing-turbine will then be discharged through the holes 4 (made in this case of greater capacity) into the inside of the drum *s* and thence, as before, to the condenser. In all these modifications the reversing-turbines run in the condenser-vacuum when the main turbine is going ahead. It is to be understood that I prefer to attach the reversing-turbines hereinbefore described to the low-pressure main turbines.

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

1. In parallel-flow turbines, in combination, a complete main turbine having its own casing and its own drum and having a plurality of rings of blades supported from said casing and a plurality of interspaced rings of blades supported from said drum, an exhaust-passage leading from said main turbine, a complete reversing-turbine having its own casing and drum and having a plurality of rings of blades carried by the casing and a plurality of interspaced rings of blades supported from the drum, said turbines being mounted on the same shaft, and the exhaust end of the reversing-turbine being connected with the said exhaust-passage from the main turbine inside the main turbine-casing substantially as described.

2. In combination, a complete main turbine having a plurality of rings of blades supported from an outside casing interspaced between a plurality of rings of blades supported from an inside drum and a complete reversing-turbine having a plurality of rings of blades supported from an outside casing interspaced between a plurality of rings of blades supported from an inside drum, the said reversing-turbine being telescoped within the said main turbine to reduce longitudinal space occupied, substantially as described.

3. In combination, a main turbine having a plurality of rings of blades supported from an outside fixed casing interspaced between a plurality of rings of blades supported from an inside revolving drum and a reversing-turbine having a plurality of rings of blades supported from an outside revolving casing interspaced between a plurality of rings of blades supported from an inside fixed drum, the said reversing-turbine being telescoped within the said main turbine, substantially as described.

4. In combination, a main turbine having a plurality of rings of blades supported from an outside fixed casing interspaced between a plurality of rings of blades supported from

an inside revolving drum and a reversing-turbine having a plurality of rings of blades supported from an outside revolving casing interspaced between a plurality of rings of blades supported from an inner fixed drum, the said reversing-turbine being telescoped within the said main turbine and the outer casing of the reversing-turbine being made

in one part with the inner drum of the main turbine, substantially as described. 10

In witness whereof I have hereunto set my hand in presence of two witnesses.

CHARLES ALGERNON PARSONS.

Witnesses:

A. B. GOLDSBROUGH,

F. A. GILLIESPY.