

No. 744,003.

PATENTED NOV. 10, 1903.

S. C. DAVIDSON.

APPARATUS FOR ENHANCING DRAFT.

APPLICATION FILED JULY 1, 1903.

NO MODEL.

4 SHEETS—SHEET 1.

FIG. 1

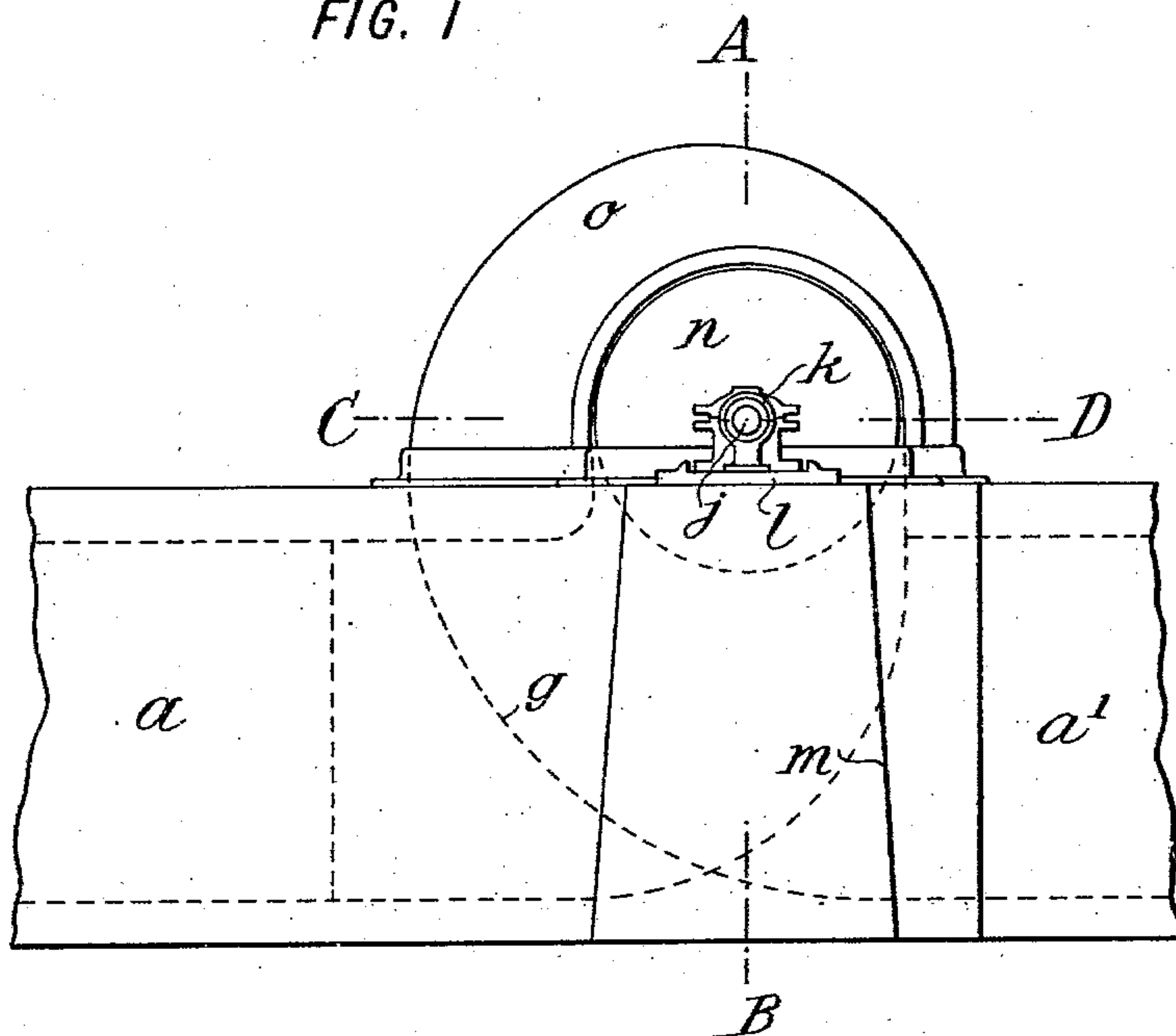
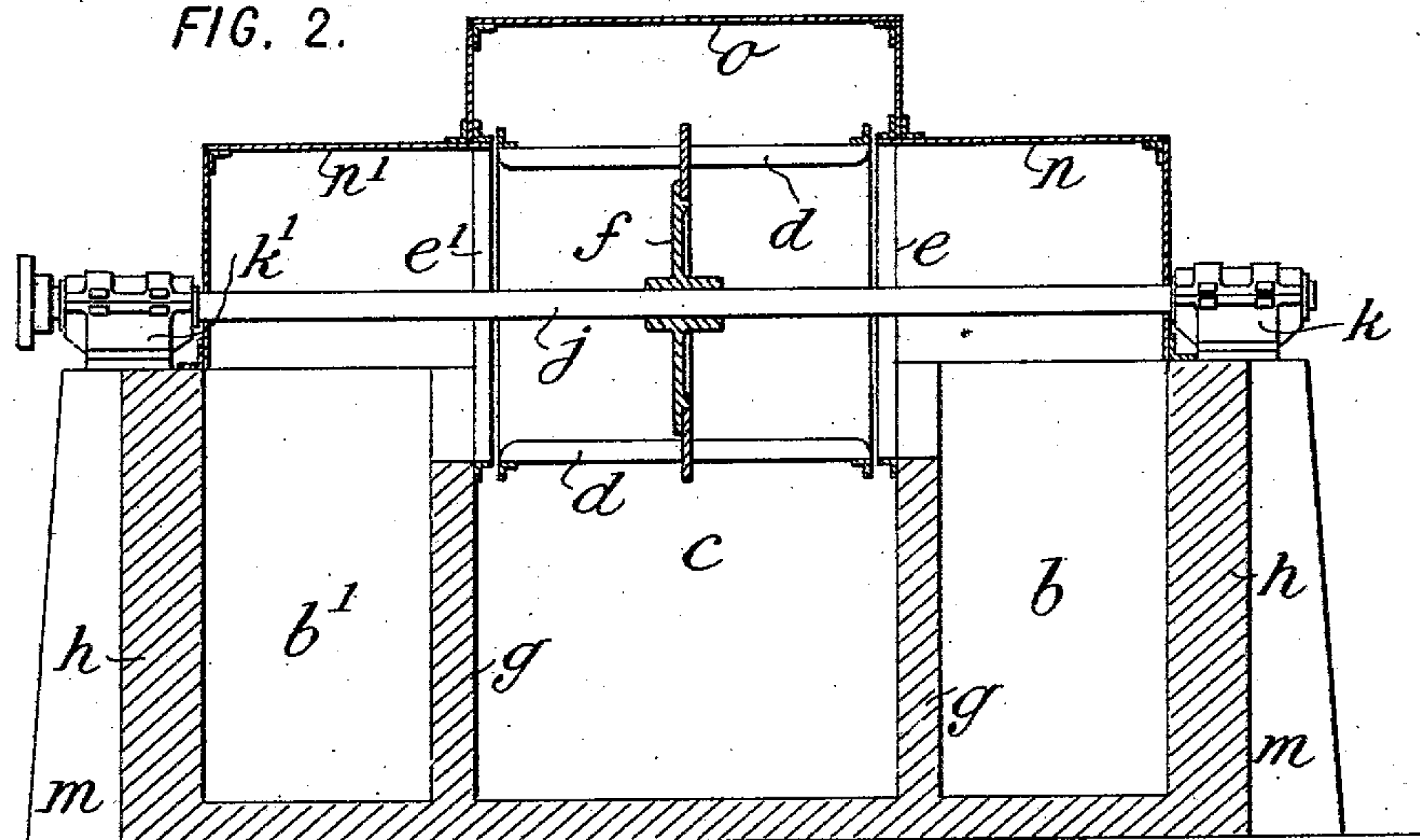


FIG. 2.



WITNESSES:

Irel White
Reed Quinn

INVENTOR:

Samuel Cleland Davidson,

By Attorneys,

Arthur C. Draper & Co.

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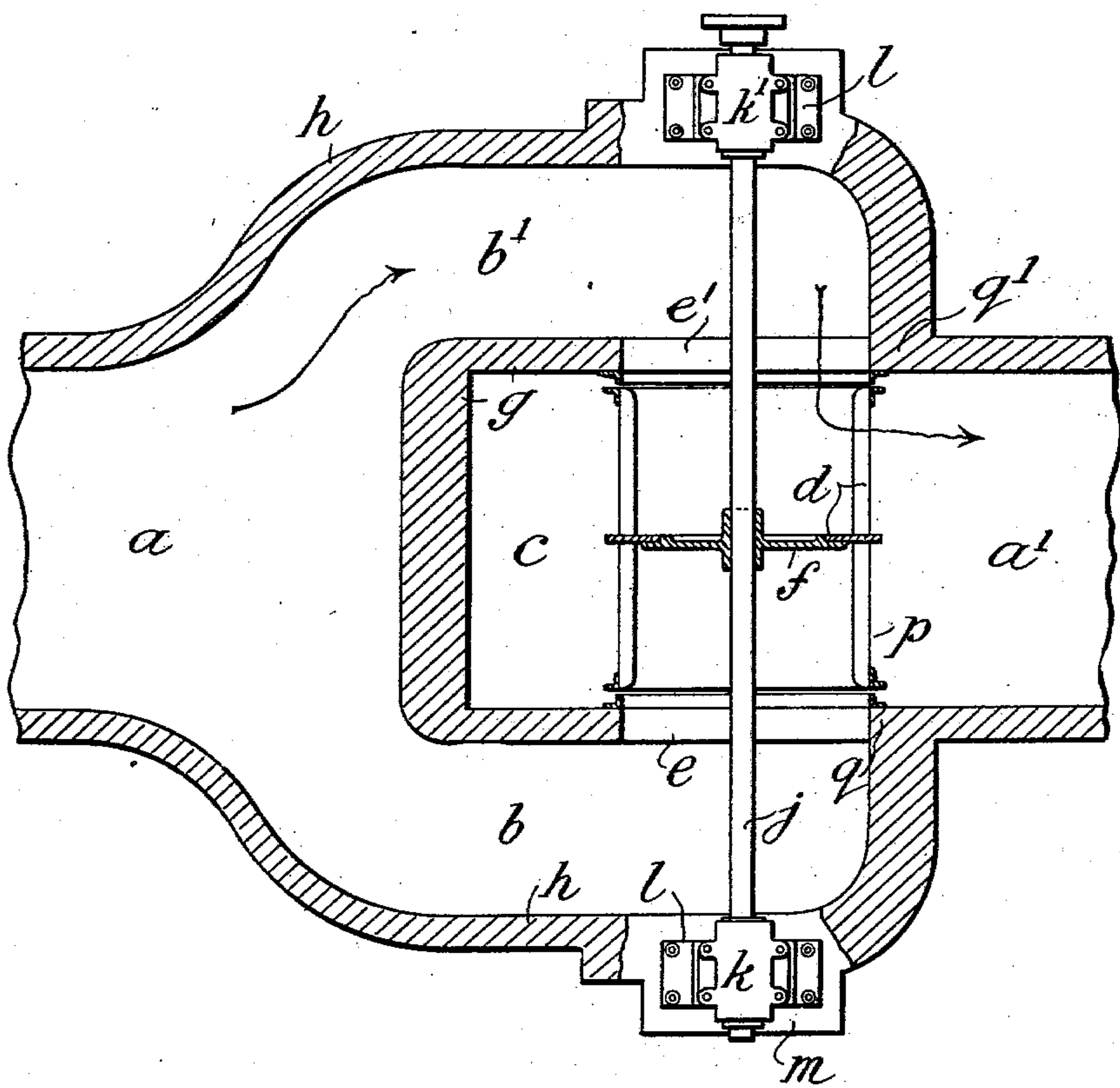
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4 SHEETS—SHEET 2.

FIG. 3.



WITNESSES:
Ired White
Rene Bruine

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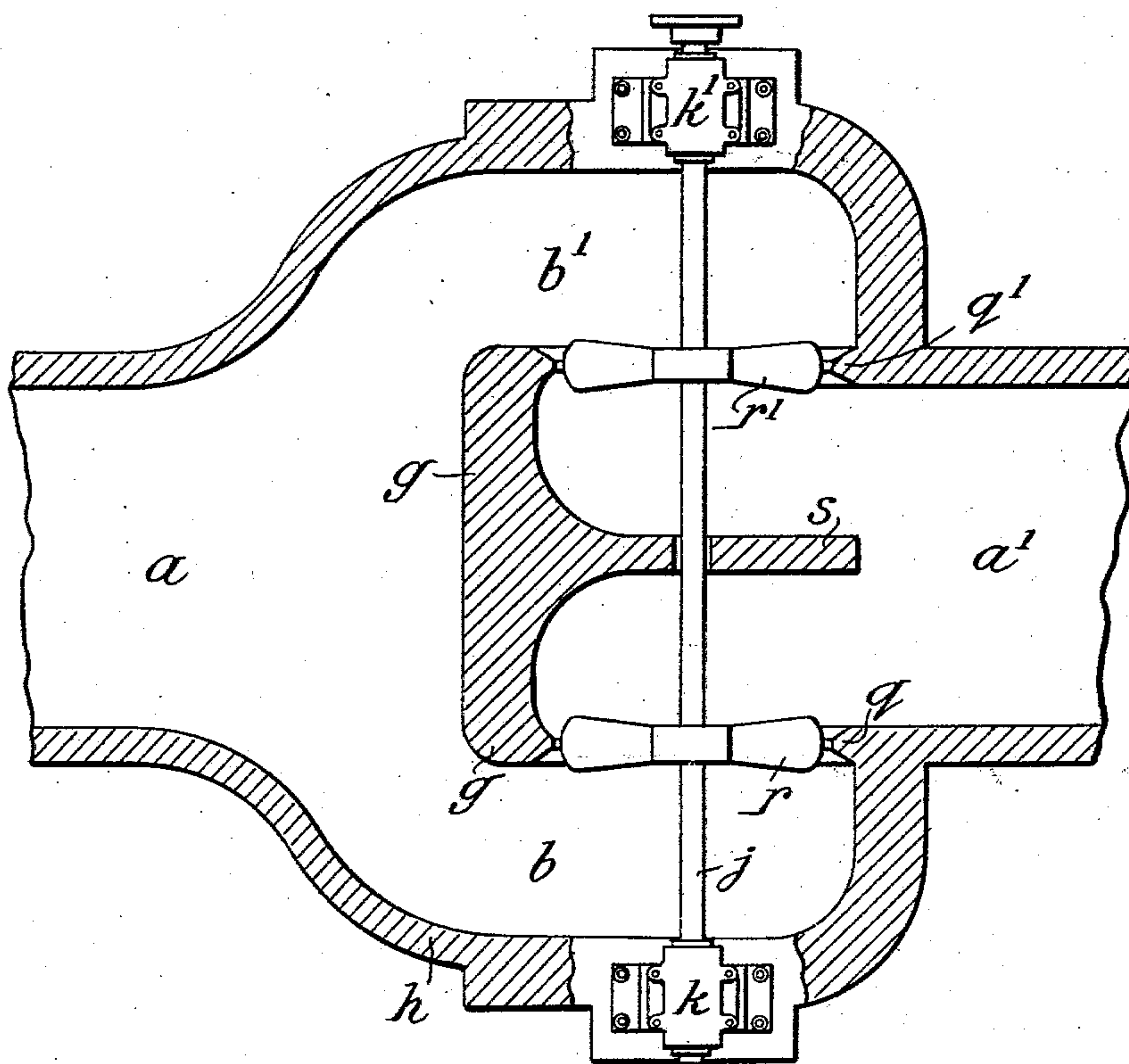
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4 SHEETS—SHEET 3.

FIG. 4.



WITNESSES:
Fred White
Reine Bruine

INVENTOR:
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No. 744,003.

PATENTED NOV. 10, 1903.

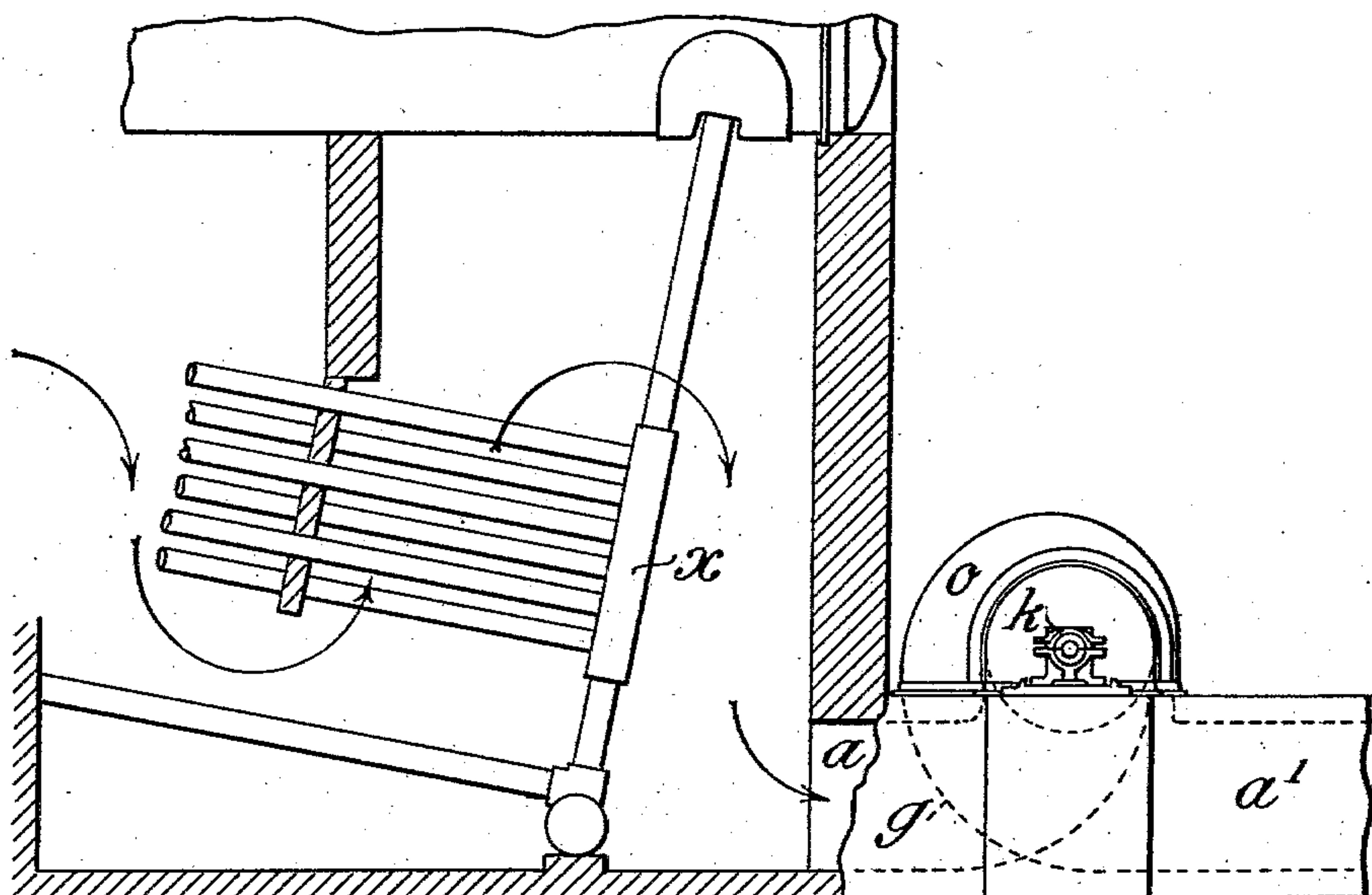
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4 SHEETS—SHEET 4.

FIG. 5.



WITNESSES:

Ives Whitely
Rene' Prune

INVENTOR:

Samuel Cleland Davidson,

By Attorneys,

Arthur C. Draper

UNITED STATES PATENT OFFICE.

SAMUEL CLELAND DAVIDSON, OF BELFAST, IRELAND.

APPARATUS FOR ENHANCING DRAFT.

SPECIFICATION forming part of Letters Patent No. 744,003, dated November 10, 1903.

Original application filed April 29, 1903; Serial No. 154,771. Divided and this application filed July 1, 1903. Serial No. 163,854. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL CLELAND DAVIDSON, a subject of the King of Great Britain and Ireland, residing in Belfast, Ireland, have invented certain new and useful Improvements in Apparatus for Enhancing Draft, of which the following is a specification.

My improvements relate more particularly to apparatus for enhancing draft through the furnace-fires of land and marine boilers and of railway or road locomotives or traction-engines, (hereinafter referred to as "locomotives;") and the objects of my invention are to provide improved apparatus for producing by mechanical means a strong and effective draft through said furnace-fires with a minimum absorption of power for the operation of the same, while also providing for the alternative employment when required of what is termed the "natural draft" of the chimney or funnel connected thereto without involving the employment of damper-valves when changing over from natural to mechanical draft, or vice versa.

Chimneys of moderate height—say up to eighty feet, or thereabout, above the fire-grate—do not develop sufficient strength of draft to produce in said fires a combustion of the requisite intensity to effectively consume common and low-priced qualities of coal, which if burned with a strong draft give off more heat and develop more steam relatively to cost than high-priced qualities. Consequently a strong draft on the fires is a very important factor toward economy in cost for fuel.

According to my invention, the novel features of which are specially defined in the claims at the end of this specification, the fan is placed bodily within the flue and practically forms a constituent part thereof, and I divide the flue into passages or chambers, one or more of which are adapted to contain a fan or fans, while the others form conducting passages or chambers to the fan and through same to the flue beyond, said passages being practically so arranged and of such dimensions as to practically provide a through-passage of cross-sectional area equal

to that of the flue or of at least one-sixth of the surface area of the fire-grate being operated upon by said fan.

This application is a division of my application, Serial No. 154,771, filed April 29, 1903, and the novel features shown and not claimed in this application are claimed in said former application.

I will further describe my invention with reference to the accompanying drawings, which illustrate its application to several different forms of furnaces and flues.

Figures 1, 2, and 3 show an arrangement of my invention applied in the main flue between the boilers and chimney of a land installation, a section only of said flue being shown. Fig. 1 is a side elevation. Fig. 2 is a section on line A B of Fig. 1. Fig. 3 is a sectional plan, partly on line C D of Fig. 1. Fig. 4 is a similar view to Fig. 3, but with propeller-fans. Fig. 5 shows another application of my invention fitted on similar lines to that shown in Fig. 1 to the base of a water-tube boiler.

In Figs. 1, 2, and 3, *a* is the main flue between the boiler-furnaces and chimney of a land installation. Said main flue is widened and bifurcated so as to form passages or side flues *b b'*, disposed one on each side of a fan casing or chamber *c*, centrally located in said flue, in which a centrifugal fan *d* of the "Sirocco" type, having inlets *e e'* on each side of the same, is located, the blades in said fan being mounted on each side of a central disk *f*. The portion of the fan-casing of said fan within the main flue is constructed of brickwork, as shown at *g g*, which brickwork is of spiral form, the top of the spiral being carried to the same height as the vertical side or walls *h h* of said main flue. The axis of the fan is disposed at or about the top of said walls, the fan being carried on a shaft *j*, which rotates in bearings *k k'*, mounted on a sole-plate *l*, carried on said walls, which are strengthened by a pedestal *m*, forming an additional support for said bearings. *n n'* are rectangular sheet-metal covers over the side flues and constituting a portion thereof, and *o* is a sheet-metal crown constituting the top portion of the casing of the fan. Said crown

o and sheet-metal covers $n n'$ are removable, so that the fan can be lowered into or lifted out of place. $e e'$ are openings forming a passage-way from the flues $b b'$. p is the discharge-exit from the fan, opening into the continuation a' of the main flue to the chimney. It will be obvious that as the walls $h h'$ of the side flues join the continuation of the main flue at $q q'$, and thereby terminate said side flues, the products of combustion passing through the same from the main flue must necessarily pass through the fan-inlets into the fan-casing c and fan d before reaching the continuation a' of said main flue, and the suction action of the chimney will cause them to do so even when the fan is not rotating, while when the fan is set in motion an immediate enhancement in the velocity of travel of said gases will take place, as hereinafter more particularly described.

When necessary, the three chambers b, b' , and c combined may be of somewhat greater width than the main flue, so as to provide in said bifurcated suction-flues a united cross-sectional area of passage-way equivalent to preferably not less than one-sixth of the area of the fire-grate being dealt with, and the inlet-openings to the fan and also the discharge-outlet therefrom into the continuation of the main flue to the chimney or funnel should preferably, also, have at least the same area for passage-way of the gases in order that when the fan is not being rotated and merely the natural draft of the chimney or funnel is operative the gases will have a sufficiently free passage to the chimney or funnel to enable said natural draft to maintain approximately the ordinary effective rate of combustion which the chimney or funnel can of itself develop in the furnace-fires, so that on the fan being rotated an acceleration of this draft will take place, the strength of which on the fires will then be commensurate with the speed of the fan's rotation.

In Fig. 4 the construction and arrangement of flues and chamber are similar to Figs. 1, 2, and 3; but two propeller-fans $r r'$ are mounted in the intake-openings of the fan-casing, and the two fans thus employed are mounted on the one shaft with their blades set at opposite angles, so that while both are rotating in the same direction their discharge is toward one another, and to prevent their oppositely-flowing currents impinging into and detrimentally affecting each other I locate midway between them a divisional plate or partition s and secure the same inside the fan-casing, which in other respects is substantially the same construction and operates similarly with propeller-fans as with centrifugal fans, similar letters of reference indicating corresponding parts in this figure to those already described in respect of Figs. 1 to 3.

Fig. 5 is a view of a similar construction to Fig. 1, shown fitted to the base of a water-

tube boiler x . The view merely shows the invention as applied in one instance, and the reference-letters used correspond with Fig. 1, so that no further description is necessary.

I do not limit myself to the arrangement in which the apparatus is fitted with a removable cover, as the fans may be located bodily in the flue and built over with brickwork, suitable provision being made in the sides of said flues for the withdrawal and insertion of said fans.

In my above-described apparatus, whether the same be employed in connection with land or marine or locomotive boilers, the fans may be driven by any suitable form of motor, either direct coupled therewith or driving same by a belt or chain, and I may employ fans either centrifugal or propeller types. When the centrifugal type is employed, I preferably employ fans of the type described in the specification of previous Letters Patent granted to me and dated November 27, 1900, and numbered 662,395, as these fans have important advantages in this combination in that they occupy a very small space relatively to the volume of gases they can deal with and impart to the gases a very high velocity relatively to their speed of rotation, and I preferably use said fans of the type known as the "double-inlet" construction, in which the vanes or blades are mounted on each side of a central disk, which keeps the currents of gases entering the fans through its oppositely-located inlets from impinging into one another; but when I employ the propeller type of fan I mount one in each inlet-opening to the fan-casing.

The type of propeller-fan which I preferably employ is that described and shown in the specification of previous Letters Patent granted to me and dated July 22, 1902, and numbered 705,046, as they likewise have the important advantages of occupying a very small space relatively to the volume of gases dealt with and impart to the gases a higher velocity relatively to their speed of rotation than is the case with propeller-fans of other makes, and the construction and special curvature of the blades enable them to stand very high temperatures without warping or twisting.

In all the above modifications the strength of the draft for varying requirements is completely under control, and a much stronger draft-power can be obtained by means of my herein-described improved apparatus than would be practicable within the limits of height which necessarily apply to the funnels of locomotives or steamships and in many cases to land boilers. The introduction of the fan-casing bodily, as it were, into the main flue, as hereinbefore described, permits of the gases entering the same with a minimum of deviation from the direction of their flow through the main flue and facilitates the maintenance of large passage-ways for the

gases into and through the fan, so that the velocity of flow through the same is approximately the same as through the main flue itself, so that not only can the gases pass through the fan freely under natural draft when the fan is not rotated, but when the fan is rotated receive therefrom an accelerated velocity with a minimum expenditure of power, there being no unduly greater velocity of flow through the fan than is simultaneously set up in the main flue, whereby a very important economy of power is effected, because when the gases have to be forced through passages of any considerably contracted area relatively to that of the main flue through which they are drawn and discharged the power required to produce this acceleration on a given volume rises as the square of the enhanced velocity applied thereto, and as my hereinbefore-described invention obviates necessity for the use of contracted passages the required duties are consequently obtained with a minimum of power for the effective draft created on the furnace-fires.

Though I have described with great particularity of detail certain embodiments of the invention, yet it is to be understood that the invention is not limited to the particular embodiments disclosed. Various other applications of the invention and various modifications in the details and in the arrangement and combination of the parts may be made by those skilled in the art without departure from the invention.

What I claim is—

1. In apparatus for enhancing drafts through furnace-fires, the combination of a bifurcated flue, a fan-chamber inclosed between said bifurcations of the flue and forming part of the flue beyond, openings between said bifurcated flue and the central chamber, a fan mounted in said central chamber with its axis approximately at the top side of the flue, a shaft for said fan, and bearings for said shaft mounted on said flue-walls.

2. In apparatus for enhancing draft through furnace-fires, the combination of a bifurcated flue, a fan-chamber inclosed between said bifurcations of the flue and forming part of the flue beyond, openings between said bifurcated flue and the central chamber, a fan mounted in said central chamber with its axis approxi-

mately at the top side of the flue, a shaft for said fan, bearings for said shaft mounted on said flue-walls, and a casing inclosing the projecting part of said fan and covering the central chamber and flues adjacent to the fan.

3. In apparatus for enhancing draft through furnace-fires, the combination of a bifurcated flue, a fan-chamber inclosed between said bifurcations of the flue and forming part of the flue beyond, openings between said bifurcated flue and the central chamber, a fan mounted in said central chamber with its axis approximately at the top side of the flue, a shaft for said fan, bearings for said shaft mounted on said flue-walls, and a detachable casing comprising sheet-metal covers *n n'* over the side flues and constituting a portion thereof, and a sheet-metal crown *o* constituting the top portion of the casing of the fan.

4. In apparatus for enhancing drafts through furnace-fires, the combination of a flue having a fan-chamber forming part thereof, a fan mounted in said chamber with its axis approximately at the top side of the flue, a shaft for said fan, and bearings for said shaft mounted on said flue-walls.

5. In apparatus for enhancing drafts through furnace-fires, the combination of a flue having a fan-chamber forming part thereof, a fan mounted in said chamber with its axis approximately at the top side of the flue, a shaft for said fan, bearings for said shaft mounted on said flue-walls, and a casing inclosing the projecting part of said fan and covering the fan-chamber and the flue adjacent to the fan.

6. In apparatus for enhancing drafts through furnace-fires, the combination of a flue having a fan-chamber forming part thereof, a fan mounted in said chamber with its axis approximately at the top side of the flue, a shaft for said fan, bearings for said shaft mounted on said flue-walls, and a detachable casing covering and constituting part of the fan-chamber and the flue adjacent to the fan.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

SAMUEL CLELAND DAVIDSON.

Witnesses:

THOMAS F. WALLACE,
FRED WHITE.