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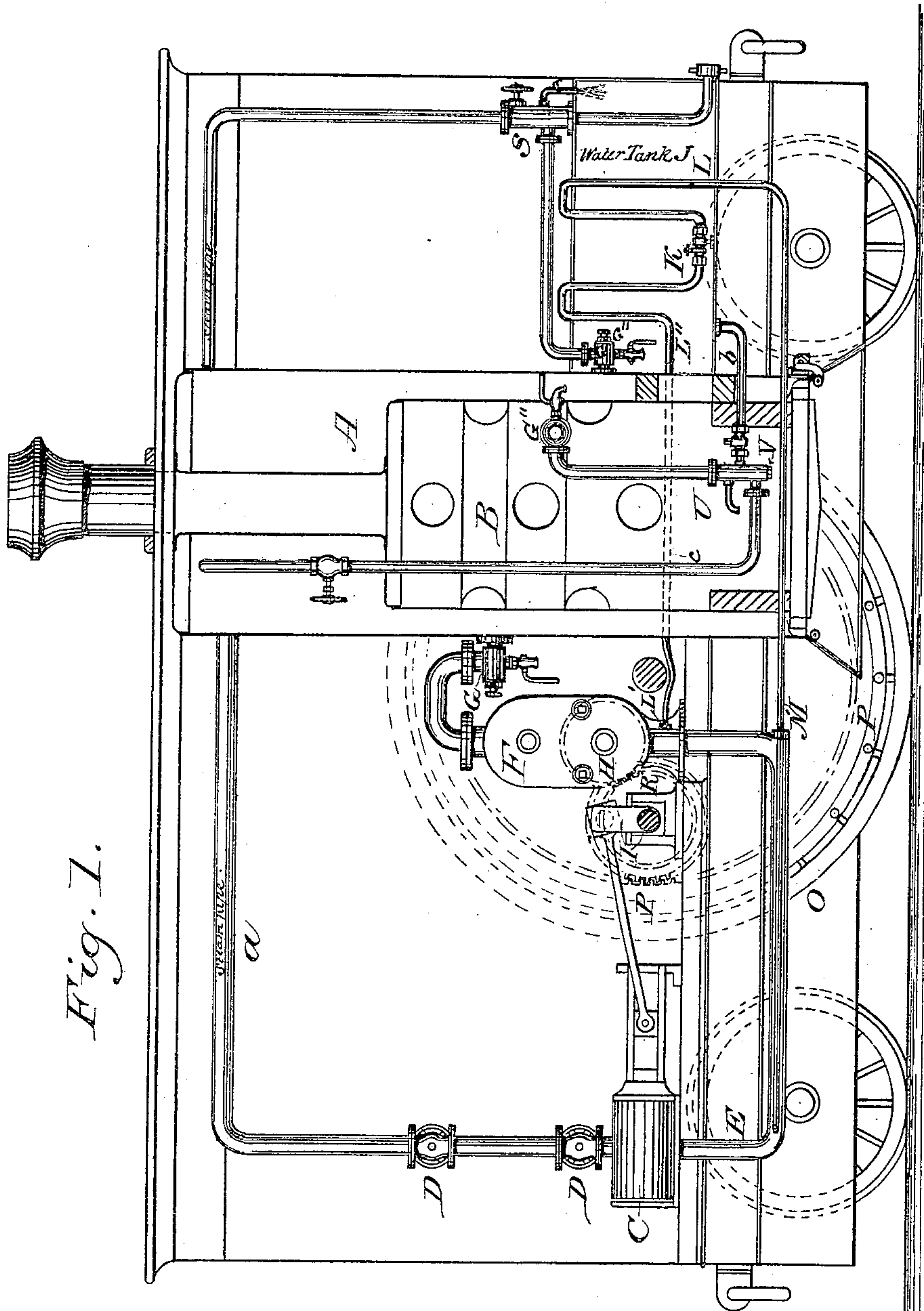
4 Sheets—Sheet 1.

J. HALL.

TRAM CAR LOCOMOTIVE.

No. 248,857.

Patented Nov. 1, 1881.



Witnesses
Chas M. Hooper
Alfred Bofhard

Signed by me
Joseph Hall

Inventor.

(No Model.)

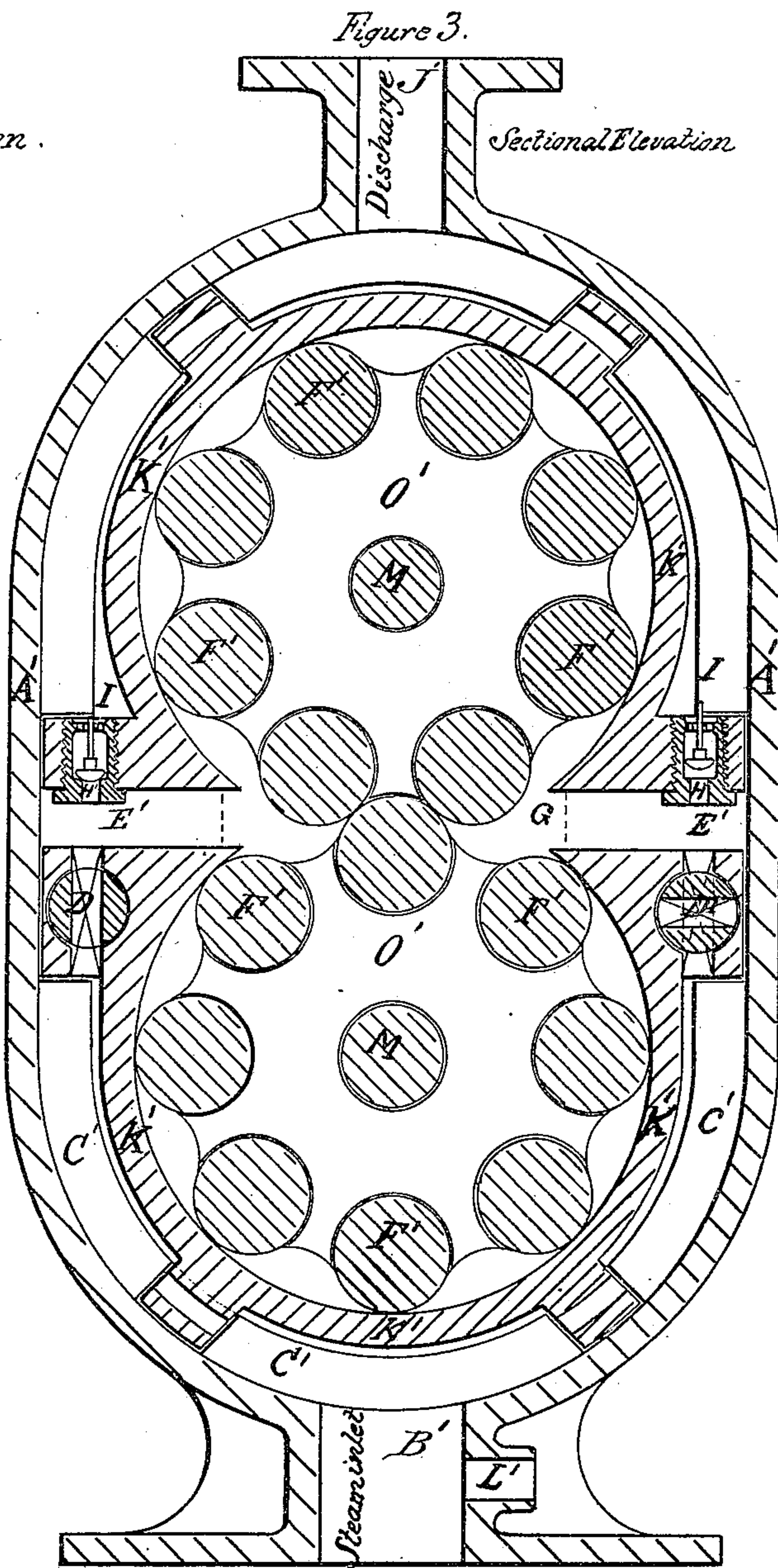
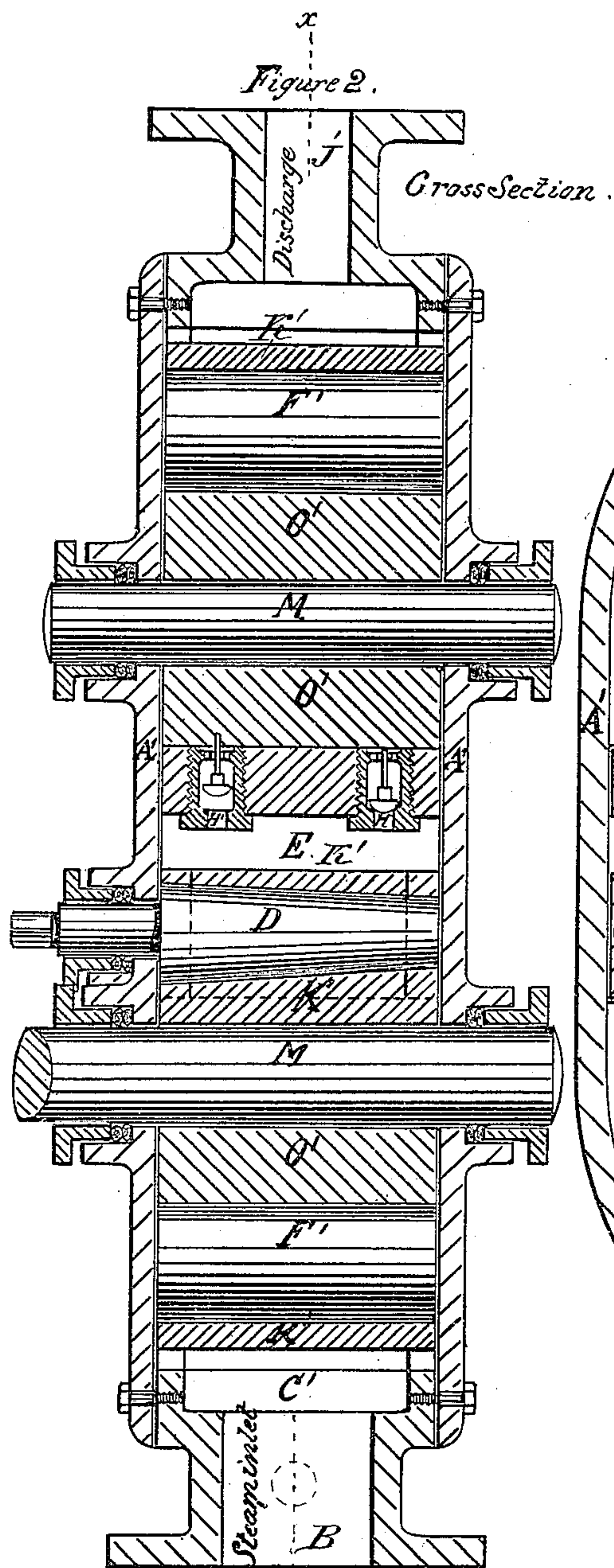
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Figure 5.

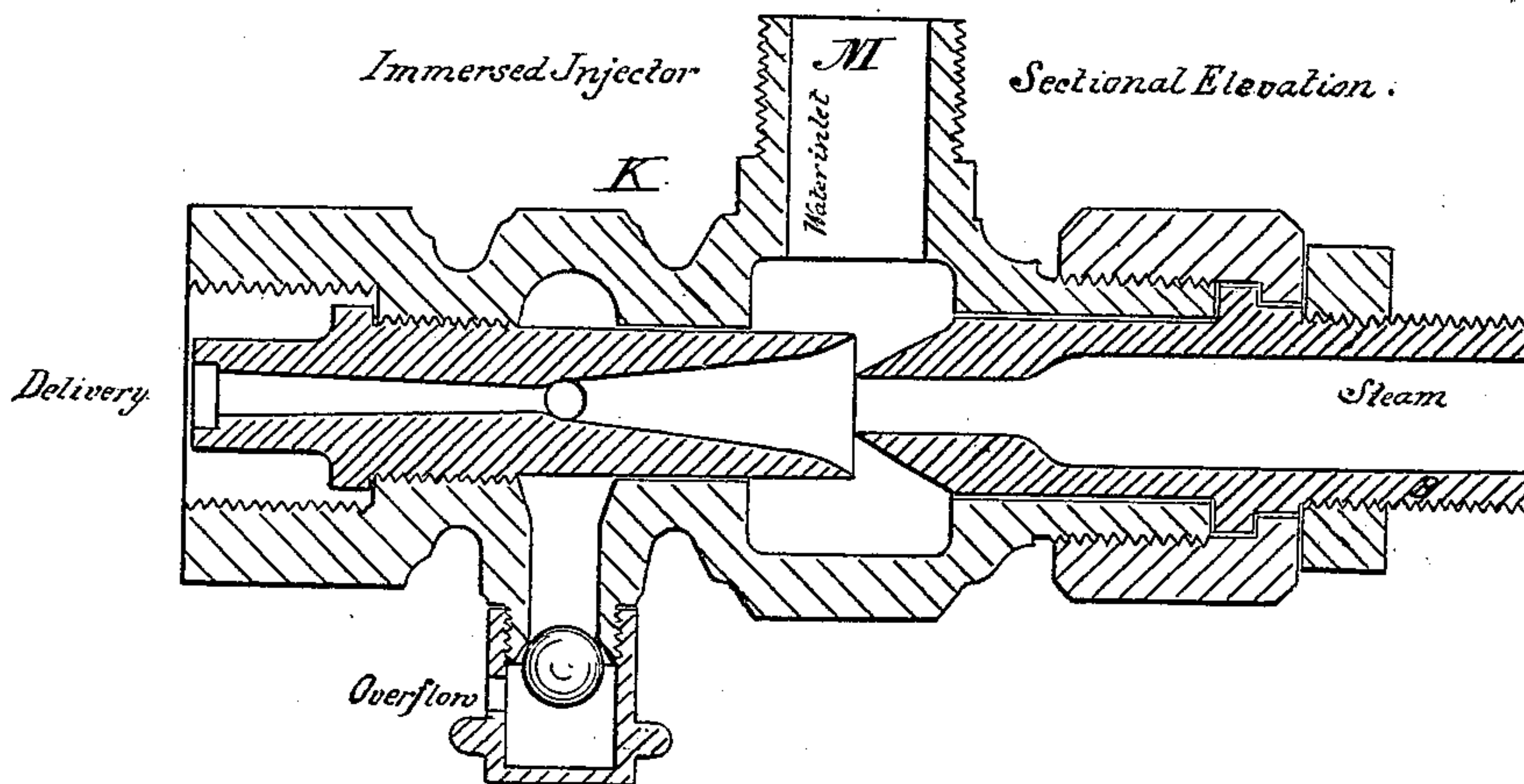
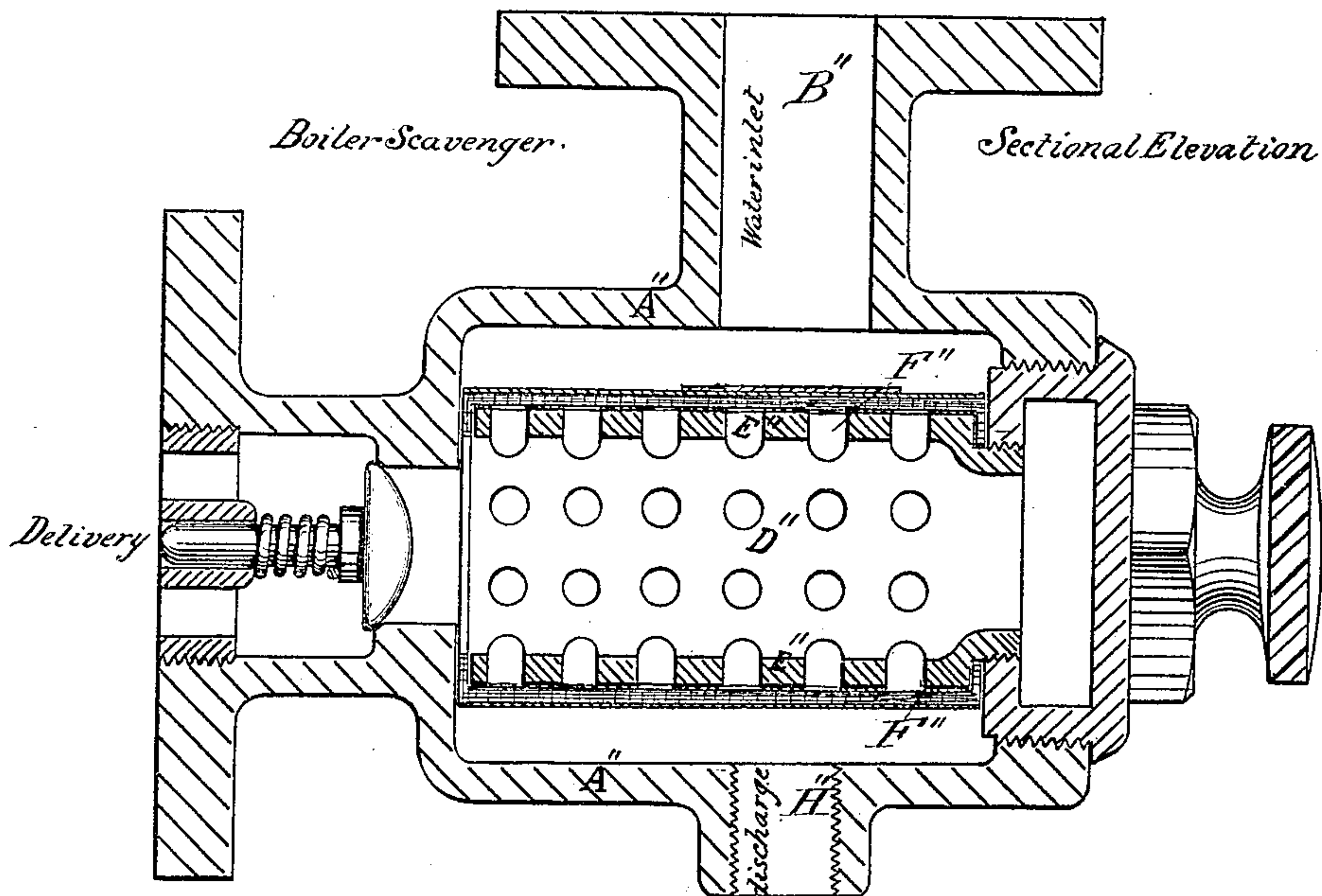


Figure 4.



Inventor.

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Joseph M. Hall

(No Model.)

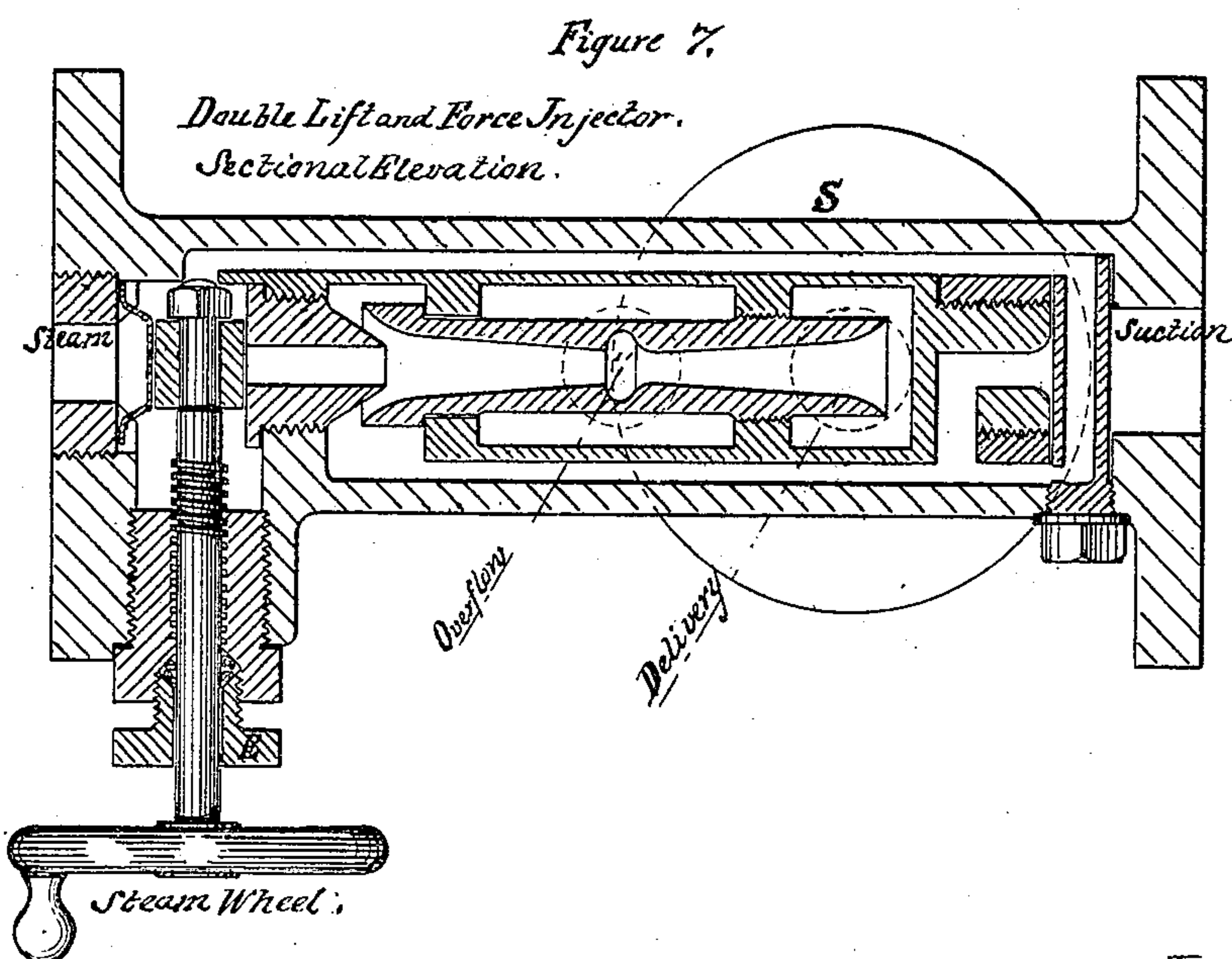
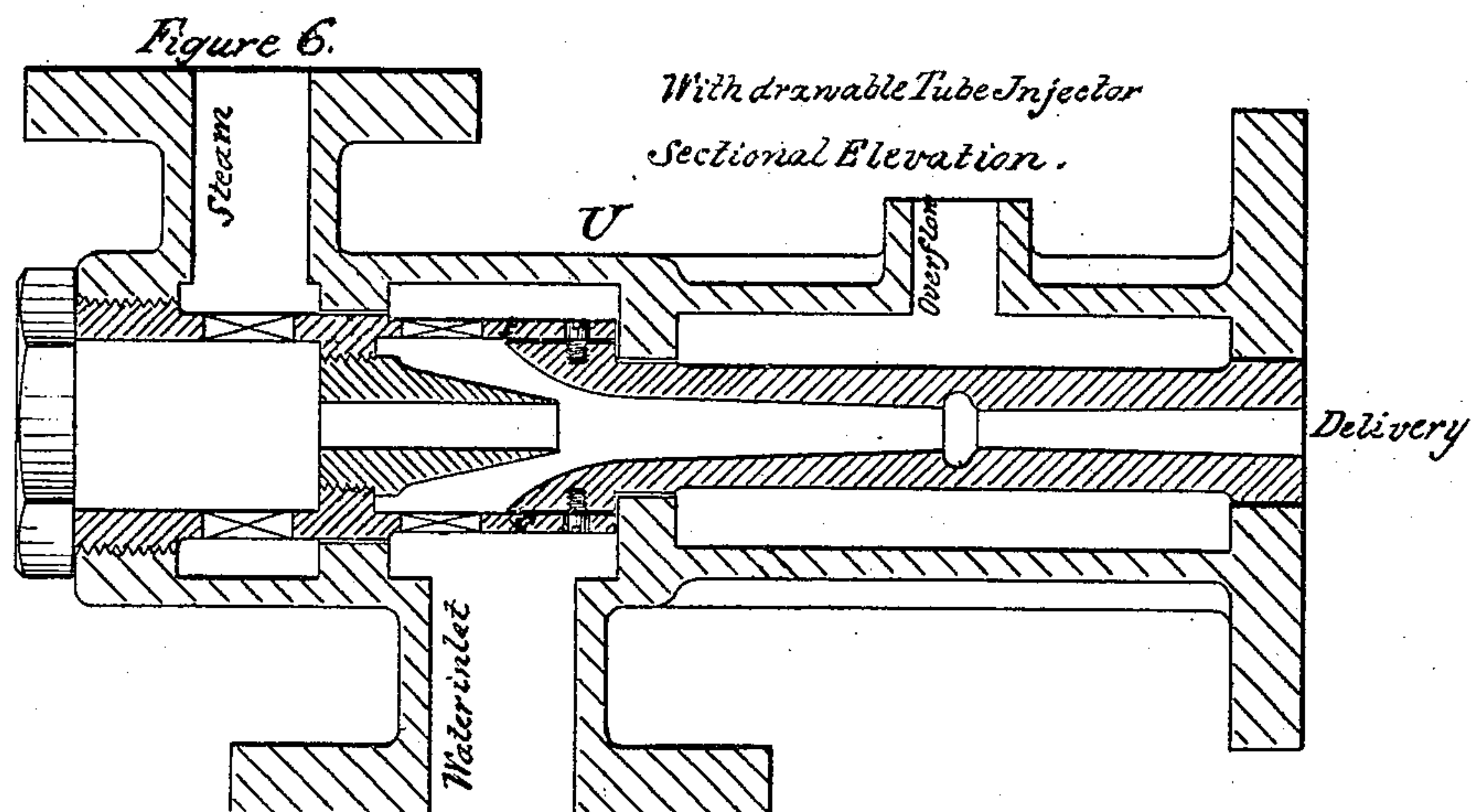
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Joseph Hall

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UNITED STATES PATENT OFFICE.

JOSEPH HALL, OF MANCHESTER, COUNTY OF LANCASTER, ENGLAND.

TRAM-CAR LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 248,857, dated November 1, 1881.

Application filed April 26, 1881. (No model.) Patented in England November 18, 1880.

To all whom it may concern:

Be it known that I, JOSEPH HALL, engineer, of Manchester, in the county of Lancaster, England, have invented Improvements in Tram-Car Locomotives and Steam-Engines, partly applicable to other purposes, of which the following is a specification.

My invention relates to improvements in locomotive, portable, traction, dummy, and other kinds of engines; and the object is to improve the construction of said engines and to return the exhaust-steam back to the boiler by an apparatus which I call a "double rotary knuckle-pump," which acts as an exhaustor, steam-condenser, and double pump for returning the whole of the exhaust-steam to the boiler, partly or wholly condensed by the one combined apparatus; and the invention consists in the construction and arrangement of parts, as will be more fully described hereinafter, reference being had to the accompanying drawings and the letters of reference marked thereon.

In the accompanying drawings, Figure 1 is a side elevation of a tramway-locomotive with my improvements attached. Fig. 2 is a vertical cross-section of the double rotary knuckle-pump. Fig. 3 is a transverse section on line of Fig. 2. Fig. 4 is a section of the apparatus for purifying and cleansing feed-water. Fig. 5 is a section of the immersion-injector. Figs. 6 and 7 are sections of the water-lifter and forcing-injector.

In the drawings, A represents a vertical boiler with cross-tubes B at right angles to each other. The fire-box sides are flattened inwardly to give a plain surface for the running-nuts upon the tube ends inside of the fire-box, and they act as stays. The steam enters the cylinders C through the steam-pipe *a* and valves D, and after working expansively therein the steam is discharged into the exhaust-pipe E, and thence into the double rotary knuckle-pump F, (to be described more definitely hereinafter,) and through the water-purifier G into the boiler. The pump F receives its motion by the pinion H and internal gear-wheel, P, arranged on the large driving-wheel C. The wheel is bolted to the spokes of the driving-wheel, but may be cast thereon, if desired. The brake-blocks (not shown) are preferably on the outer circumference of the rim

on both wheels P, with a rocking shaft at bottom, with levers for blocking and controlling the engines from either end of the locomotive. The large wheel is driven by the pinion-wheel R, keyed on the end of the crank-shaft I of the engines.

The double rotary knuckle-pump consists of an outer casing, A', made of cast iron or other suitable metal, and is provided with an inlet, B', at bottom, and outlet J' at top. Within the casing A' is the inner casing, K', and in this are arranged on shafts M two block-wheels, O', in which are journaled a number of hollow or solid rollers, F', in such manner that they mesh closely into each other as they are revolved. Midway of the inner casing is arranged a partition, G, in which the plug-cocks D D' are pivoted, and on each side is arranged a back-pressure valve, H H', seated in plugs E' E'. These valves are alternately opened or closed on one side as the wheels O' are rotated in one or the other direction. The water passes through the spaces C' and I to either side. On one side of the bottom nozzle or inlet is introduced a pipe-inlet, L', for the condensing-water from the automatic immersed injector K. This injector is shown in detail view in Fig. 5, and connects by the supply-shank M'' with the water-tank J, and is operated by exhaust-steam coming through the exhaust-pipe M' from the main exhaust-pipe. The outlet-pipe L'' connects with inlet L' of the rotary pump F, and thus assists in condensing the exhaust-steam which is drawn into the double rotary pump F, and by it is forced through the cleaner or purifier G into the boiler.

The purifier G is represented in section in Fig. 4, and consists of a body, A'', of cylindrical form, having a water-inlet, B'', in connection with feed-pipe. Within the casing A'' is inserted a perforated tube, E'', through which the water passes into the internal chamber, D''. The outside of this tube E'' is covered preferably with carded and rolled wool F'', (known as "printer's blanket,") and over this is placed a wire-gauze of very fine mesh, to keep the dirt or sediment from the blanket. On the inside of the blankets I place another wire-mesh lining to support the blanket. H'' is the refuse-discharge opening. In connection with engines of this kind named, I arrange an

injector, U, provided with a removable internal tube, B''', for the purpose of cleaning. This injector is connected by a pipe, b, with the water-tank, and by another pipe, c, with the steam in the boiler, and water from said tank is forced by the steam through an additional purifier, G'', into the boiler. This injector is to be used in case the engine is at rest, and for muffling the steam in case of excessive pressure. An additional injector, S, is employed for lifting water from a well or other water-receptacle and depositing it into the tank or forcing it into the boiler, as desired.

I reserve to myself the right to make a separate application for Letters Patent for the immersed injector and the double-lift and force injector, as also the water-purifier.

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

1. The method herein described of returning the exhaust-steam of an engine, consisting in partly condensing the said exhaust-steam by means of an injector, K, and forcing said steam by the double rotary knuckle-pump F through the purifier G into the boiler, substantially as shown and described.

2. A double rotary knuckle-pump consist-

ing of an outer and inner casing, A' K', having inlet and outlet B' J' E', wheels O', provided with rollers F', in combination with cocks D' D' and valves H H', arranged substantially as and for the purpose set forth.

3. In a locomotive or portable engine, the combination of a cylinder, C, exhaust-pipes E M', immersed injector K, double rotary knuckle-pump F, and cleaner G, with a tank, J, injector U, and the boiler A, all arranged substantially as shown and described.

4. In a locomotive or portable engine, the combination of a cylinder, C, exhaust-pipes E M', immersed injector K, double rotary knuckle-pump F, and cleaner G, with a tank, J, and injector S, cleaner G'', and the boiler A, all arranged substantially as and for the purpose specified.

In witness whereof I, the said JOSEPH HALL, have hereunto set my hand this 3d day of March, in the year of our Lord one thousand eight hundred and eighty-one.

63 Royal Exchange, Manchester, in the county of Lancaster, England.

JOSEPH HALL.

Witnesses:

CHARLES HOOPER,
ALFRED BOSSHARDT.