No. 615,371. Patented Dec. 6, 1898.

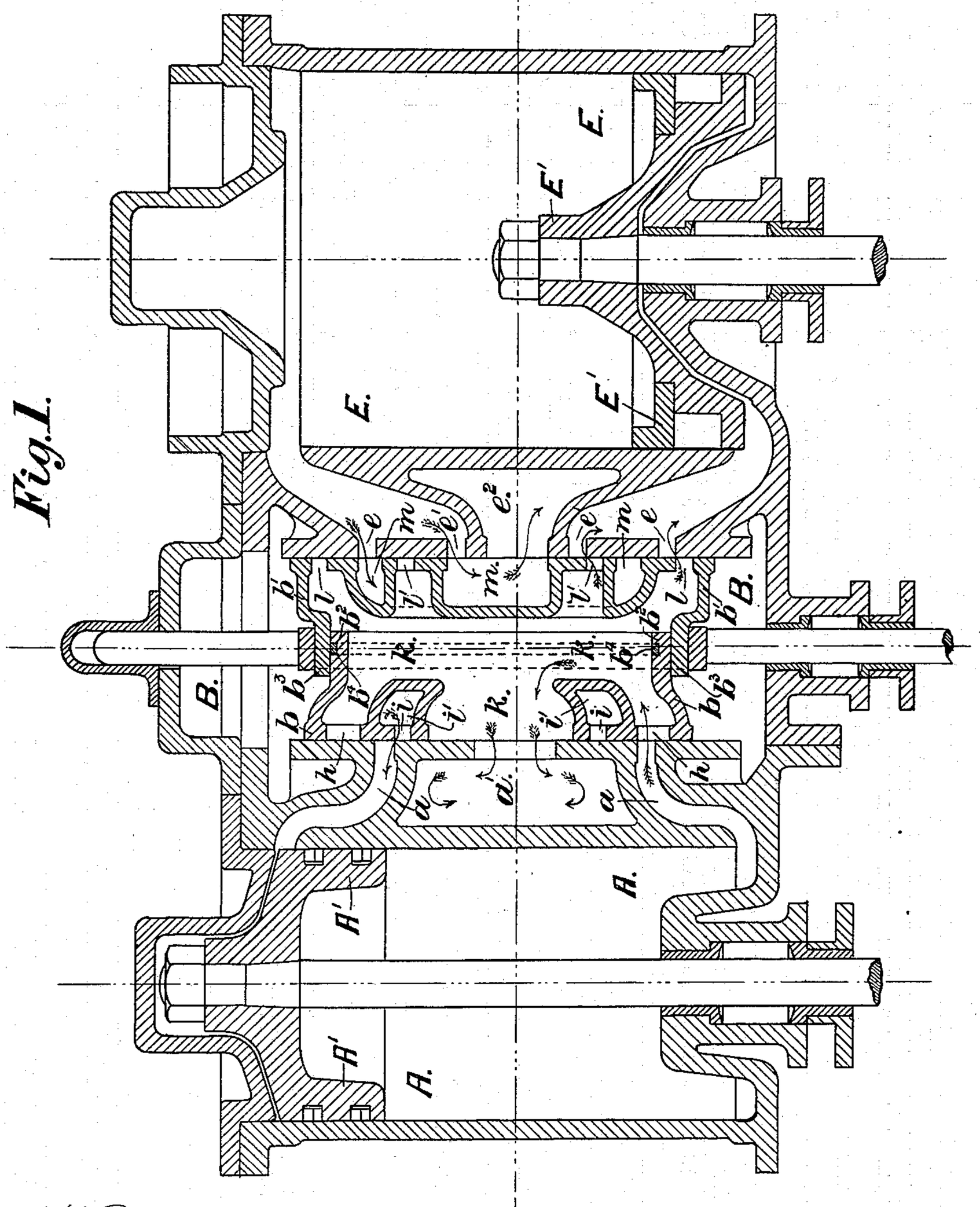
J. THOM.

STEAM ENGINE.

(Application filed Dec. 21, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses.
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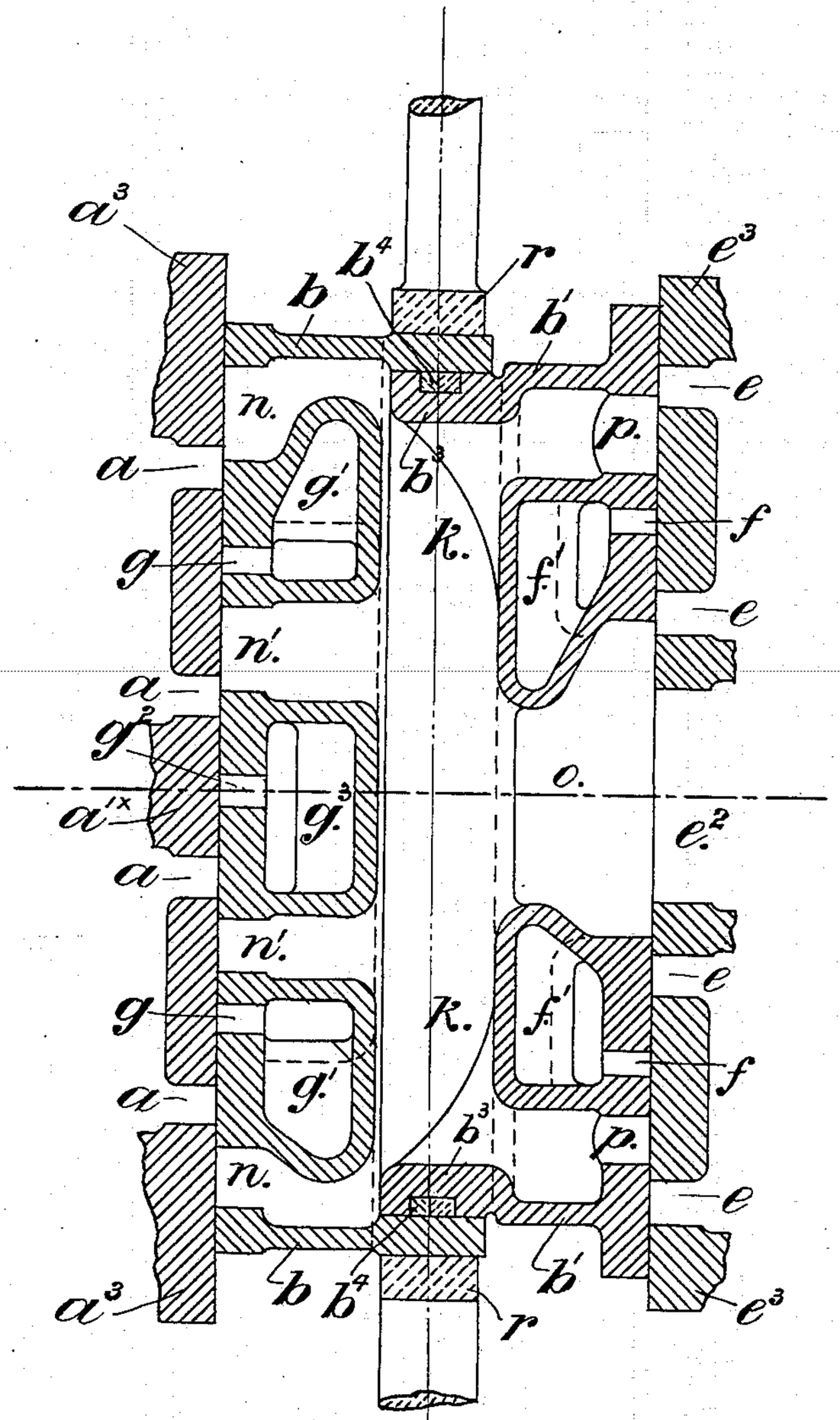
(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



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No. 615,371. Patented Dec. 6, 1898.

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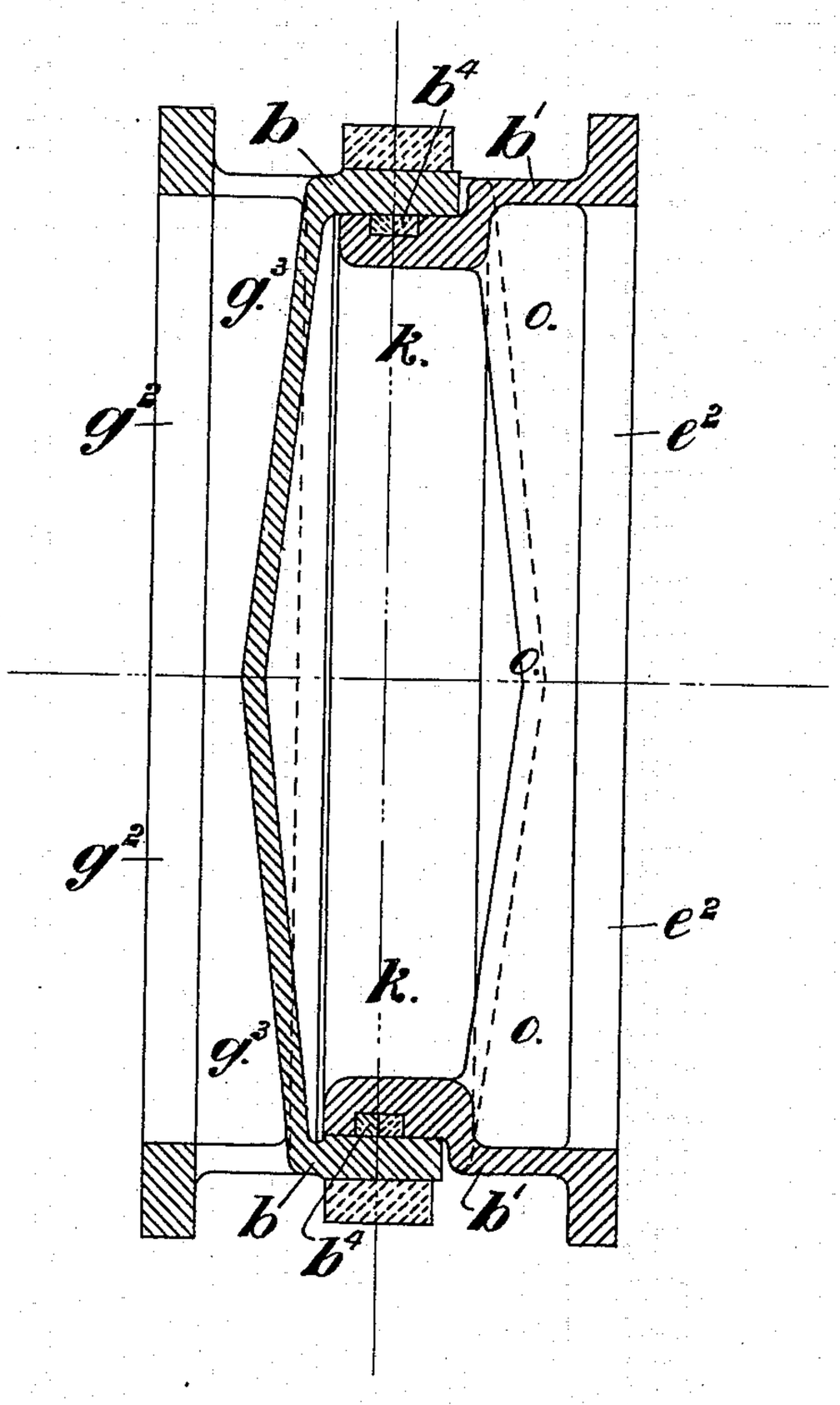
4 Sheets—Sheet 3.

Fig. 3.



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No. 615,371. Patented Dec. 6, 1898.

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STEAM ENGINE.

(Application filed Dec. 21, 1897.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 4.

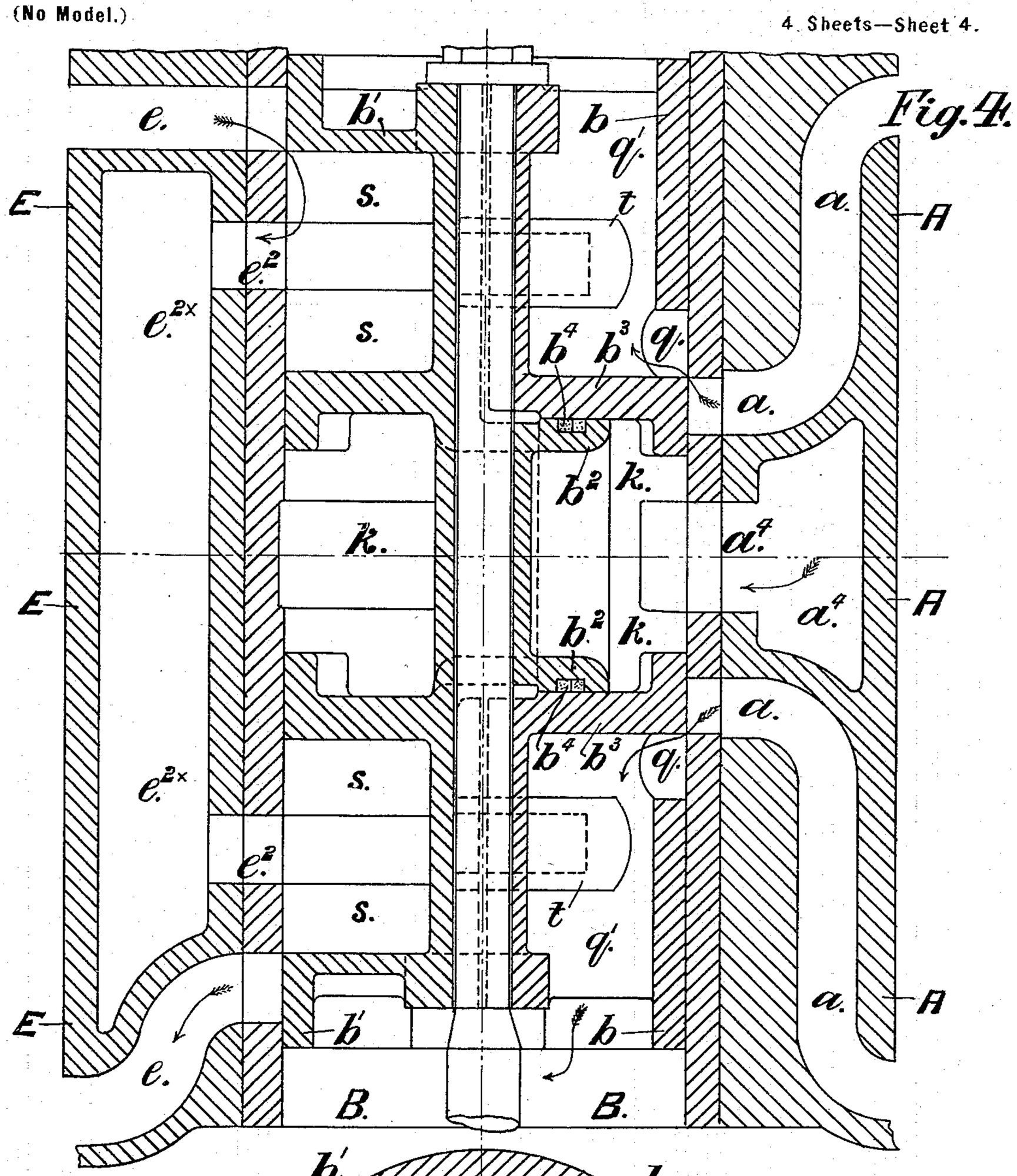
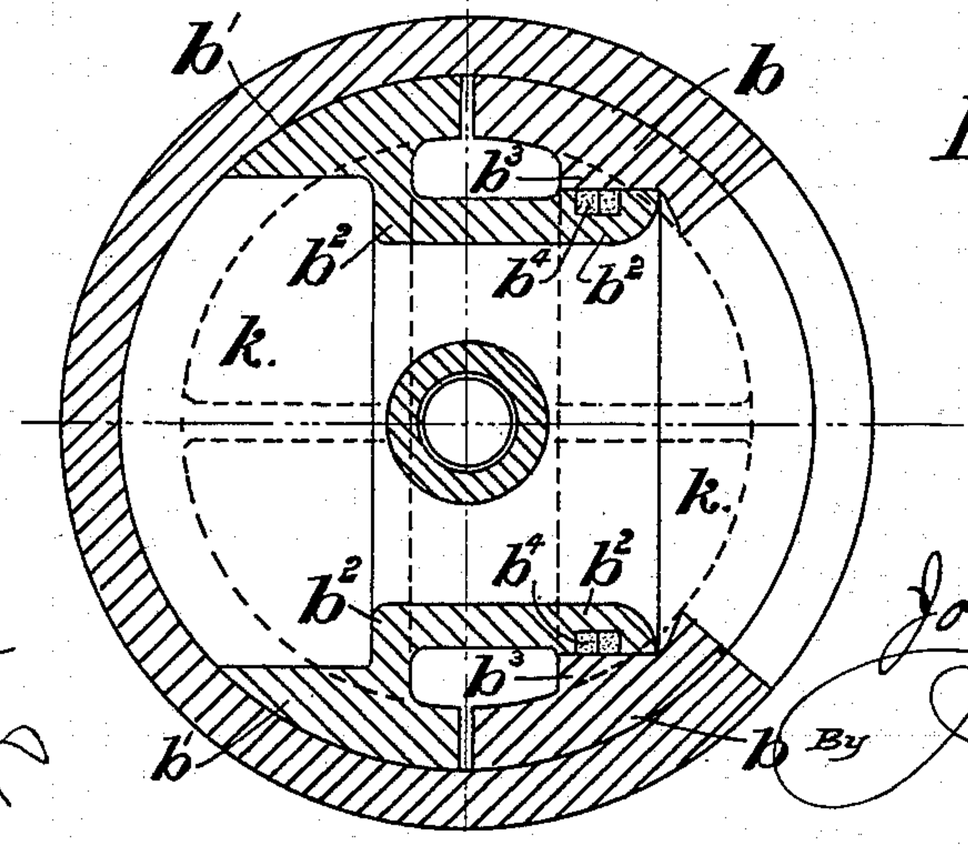


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN THOM, OF GLASGOW, SCOTLAND.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 615,371, dated December 6, 1898.

Application filed December 21, 1897. Serial No. 662,879. (No model.)

To all whom it may concern:

Be it known that I, JOHN THOM, consulting engineer, a subject of the Queen of Great Britain and Ireland, residing at 194 St. Vincent street, Glasgow, in the county of Lanark, Scotland, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification.

This invention has reference to the distribution-valves of fluid-pressure engines, chiefly steam-engines—*i. e.*, to the valves for supplying or distributing the working fluid to and from the cylinders.

It is applicable for distributing steam to engines having two cylinders disposed side by side and having two port-faces and sets of ports where the valve for both cylinders is operated by a single valve-gear, and it is also applicable to engines in which the steam to and from each cylinder is distributed by a separate valve or valves.

According to this invention the distribution-valves of fluid-pressure engines are made in duplex form—*i. e.*, in two separate parts—each part having a face and adapted to move in relation to each other in a direction at right angles to the direction of motion of the valve, so that the distance between the faces of the two parts can be varied and the two faces rendered adjustable up to the cylinder-port faces of the two cylinders or the single cylinder, as the case may be, in connection with which it or they work, while in the direction of motion the two parts are immovable.

The invention will be described with the aid of the accompanying drawings, which show several modifications under the invention.

Figure 1 is a sectional elevation showing two cylinders of a compound engine adapted to use steam at different pressures, in which one valve consisting of two parts with flat faces is adapted to distribute steam to and from the two cylinders, the pistons of which work on cranks pitched apart at one hundred and eighty degrees, and one valve and gear is used in connection with the two cylinders. Fig. 2 is a sectional elevation, and Fig. 3 a cross-section, showing a modification of the duplex flat-faced valve of the kind shown in Fig. 1. Fig. 4 is a longitudinal section, and Fig. 5 a cross-section, showing a duplex piston-valve, according to the invention, for supplying steam to two cylinders using steam of different pressures.

Referring in the first instance to Fig. 1, A is a cylinder in which steam at the higher pressure is used, and E is a larger cylinder in which the steam is expanded after having been employed in A. These may represent a compound engine or two cylinders of a compound engine, wherein steam is expanded in a larger number of cylinders.

A′ is the piston of A, and E′ is the piston of E these two pistons being of course at opposite ends of their respective cylinders, and their cranks would be at one hundred and eighty degrees from each other. Each of the cylinders has a flat port-face, and each part of the distributing-valve has a corresponding flat face.

The duplex valve consists of two parts $b\,b'$, the part b being adapted to distribute steam to and from the cylinder A and the part b' to distribute it to and from the cylinder E. These two parts $b\,b'$ are joined together by a sliding steam-tight joint at their backs—namely, the two parts $b\,b'$ have parts b^2 and b^3, respectively, which consist in the case shown of annular necks on the rectangular backs of the two valve portions $b\,b'$, the one, b^2, fitting inside the other, b^3, and makes a sliding steam-tight joint therewith, steam-tightness being provided by a packing-ring b^4. Thus while these two parts $b\,b'$ of which the valve is composed, are immovable in relation to each other in the direction of the planes of their faces they are free to move in relation to each other in a direction at right angles to their faces.

In the case shown, Fig. 1, the cylinder A has two steam-ports a and a central space a' (which is a dead or neutral space) in its port-face, while the cylinder E has double steam-ports e and e' at each end and a central exhaust-port e^2. The port b of the valves works in connection with the cylinder A and has two ports h and i, the port i being for the admission of steam to the cylinder A and the port h for the exhaust therefrom. The port i communicates with the valve-case B (to which the steam at initial or higher pressure is admitted) by way of the passages i', which extend through the valve part b from side to

side. The interior of this part b, and also the part b', constitutes a closed chamber and passage for the steam, the whole of which is generally designated k. The portion b' of the valve is provided with double steam-ports $l\ l'$ and a single exhaust-passage m, common to the two cylinder-ports $e\ e'$.

In action steam from the steam-chest B enters A by way of the steam-passages i', valve-port i, and cylinder-port a, and its exhaust therefrom and passage to E takes place by the ports a, valve-ports h, chamber k, valve-ports $l\ l'$ of b', and cylinder-ports $e\ e'$, and its exhaust from the cylinder E is by the ports $e\ e'$, the exhaust-passage m of b', and the central exhaust-port e^2 of E. By the construction of valves shown it will be seen that the higher-pressure steam in the valve-chest B, acting on the valves and tending to press them onto their respective cylinder-port faces, will be due to the area of the back of the valve-ports $b\ b'$ less the area of the cylindrical joint portions $b^2\ b^3$. This refers to the outside of the portion $b\ b'$; but as regards the interior of the valve the parts which are acted upon and tend to press the two ports into their faces will only be subject to the pressure of steam within the chamber k, which of course is of lower pressure.

In the modification shown in Figs. 2 and 3 a duplex flat-faced valve of the kind shown in Fig. 1 is given, which is adapted to distribute steam to two cylinders in which steam of the same pressure is used, the cranks operated by the two pistons of these two cylinders being opposite each other—*i. e.*, one hundred and eighty degrees pitch from each other. In this case the two cylinders, of which the port-faces a^3 and e^3, respectively, only are shown, are double-ported, each having two ports $a\ a$ and $e\ e$ for supplying steam to and from each end of their respective cylinders. In the center of the port-face a^3 there is simply a bar of metal $a'^{\times}$, dividing the two inner ports a from each other, while in the other cylinder-port face e^3 there is a central port e^2, which acts as a common exhaust-port to both cylinders. Steam is admitted to the right-hand cylinder through its ports $e\ e$ over the back or outer edges of the part b' of the valve and through the inner ports f, to which steam is admitted from the valve-case B by the passages f', extending through the valve from side to side, and it enters the other cylinder through its ports $a\ a$ by the ports g, which are conveyed from the valve-chest B by the passages g', extending through the valve-port b from side to side, and a central port g^2, steam to which is supplied from the valve-case by the through-passage g^3, similar to g', which is common to the inner cylinder-ports of both ends of the cylinder. The exhaust from the left-hand cylinder takes place through the valve by the ports $n\ n'$ of the part b of the valve, which lead into the central common chamber or passage k, which leads direct by way of the opening o into the exhaust-port e^2 of the right-hand cylinder. The exhaust from the right-hand cylinder takes place partly through the outer cylinder-ports e and the valve-port p in b', chamber k, and the central port or opening o and partly by the inner ports e, which lead direct into o. In this case, therefore, the valve opening or port o and the cylinder-port e^2 serve as common ports for the discharge of steam from two cylinders. The adjustment and relative movements of the two valve parts $b\ b'$ are the same as in the former case. Both in this case and in that shown in Fig. 1 the two portions $b\ b'$—*i. e.*, the whole valve—is operated from the valve-gear by the girdle r, which spans the outer annular neck of the sliding joint of the two parts.

Referring now to Figs. 4 and 5, these show duplex piston-valve as applied to the distribution of steam to and from two cylinders using steam of different pressures—*i. e.*, for an ordinary compound engine. In this case A represents part of a higher-pressure cylinder, with steam-ports a, and E is part of the lower-pressure cylinder, with steam-ports e and exhaust-ports e^2. The steam in this case enters first the central portion or chamber k between the two ends of the valve through a port and passage a^4 in the cylinder A between the two ports a. About this inner chamber k, as will be seen, the sliding joint between the two portions $b\ b'$ of the valve is made—*i. e.*, the part b' has an annular ring or hollow trunk b^2, which fits and slides in the corresponding cylinder b^3 in the portion b and has packing-rings b^4, by which a steam-tight joint is made with b^3. By this means and by the general construction shown the net pressure of the higher-pressure steam tending to force the two parts $b\ b'$ of the valve onto the cylinder-port faces is rendered as small as possible. The exhaust from the cylinder A takes place through the ports q in the shell of the valve portion b and passes by way of the chamber q' therein into the valve-chest B. From here it passes by way of the ports e of the cylinder E over the metal at the ends of the portion b', and the exhaust from this cylinder takes place by way of the chamber s in the portion b' and the exhaust-ports e^2 in the valve, which lead direct in the space $e^{2\times}$, which is a common exhaust-space to the two ports e^2. The two portions $b\ b'$ of this valve are normally pressed asunder onto the cylinder-port faces by springs in casings t, as hereinafter described more fully in connection with the valves shown in Fig. 5. The net area for the steam to act on these two halves $b\ b'$ to keep them on their faces can be made practically anything required.

What is claimed is—

1. In an engine a high and a low pressure cylinder arranged parallel to each other with their respective cranks arranged opposite each other, a steam-chest B arranged between said cylinders, and having ports at the opposite ends of the said cylinders, and a duplex

valve consisting of two parts b b', located in said steam-chest and having two faces working respectively in connection with the ports of the steam-chest, and two trunks b^2 b^3 working in connection with each other and forming a sliding steam-tight joint between them, and forming a chamber k within such hollow trunk, constituting a steam-passage for the flow of steam from one port of the engine to another, substantially as described.

2. In an engine a high and a low pressure cylinder arranged parallel to each other with their respective cranks arranged opposite each other, a steam-chest B located between said cylinders, ports at the opposite ends of said faces leading to the opposite ends of said cylinders, and a duplex valve located in said steam-chest and consisting of two parts b b' having two faces working respectively in connection with the said cylinder-ports and two trunks b^2 b^3 working in connection with each other and forming a sliding steam-tight joint between them, and forming a chamber k within such hollow trunk constituting a steam-passage for the exhaust-steam direct from the high-pressure cylinder to the low-pressure cylinder, substantially as set forth.

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

JOHN THOM.

Witnesses:
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THOS. PICKEN.