

(No Model.)

3 Sheets—Sheet 1.

A. KNUDSEN.
STEAM ENGINE.

No. 501,793.

Patented July 18, 1893.

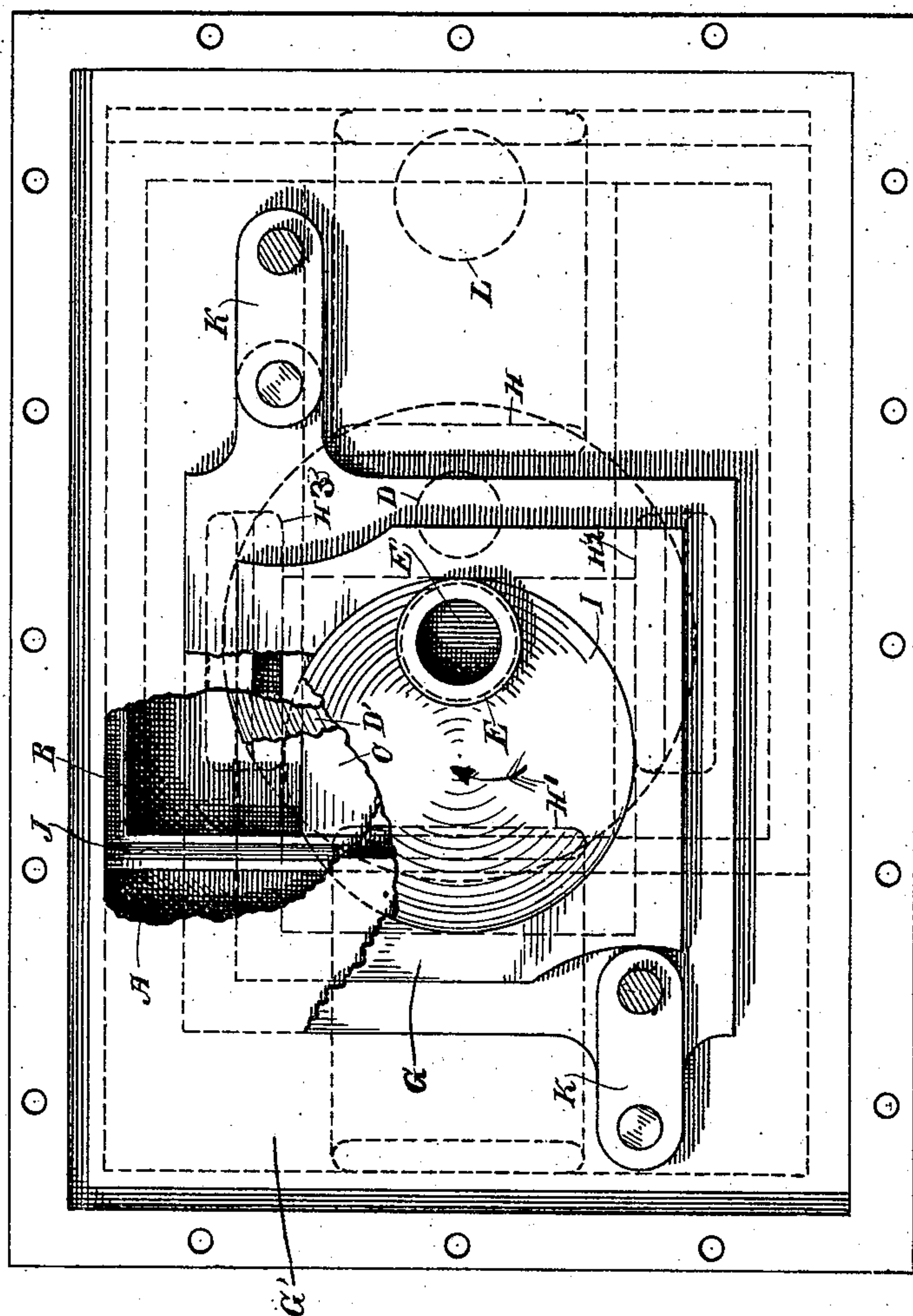
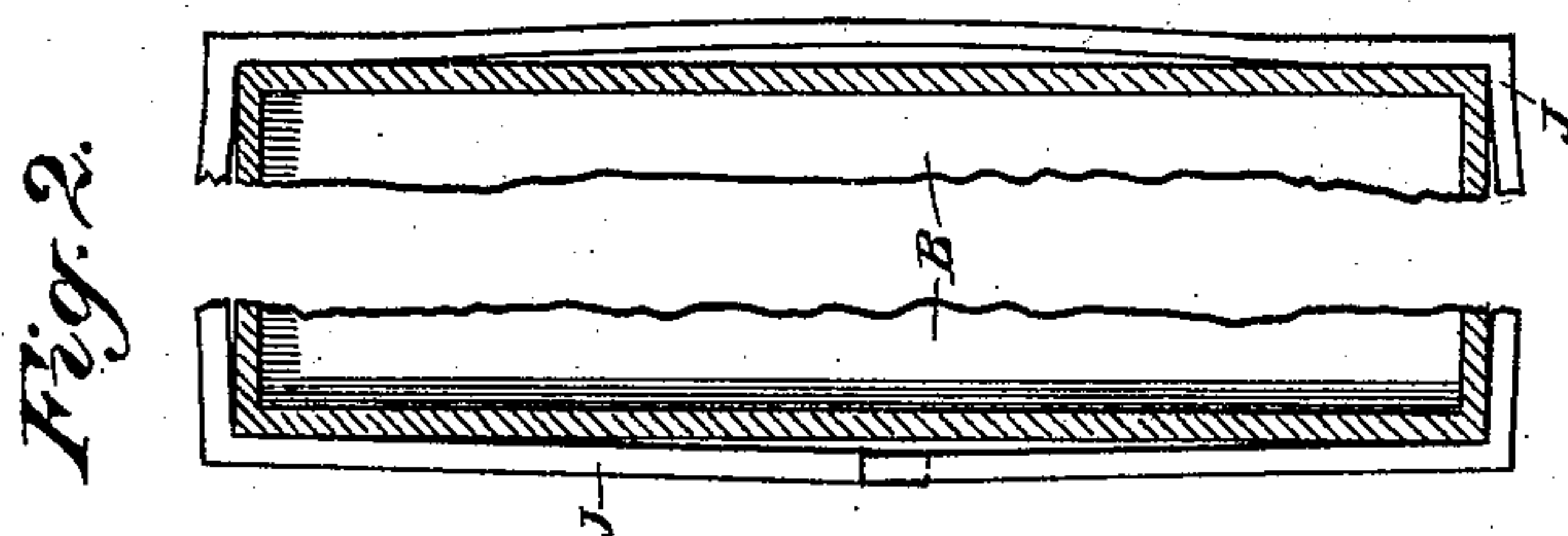


Fig. 1.

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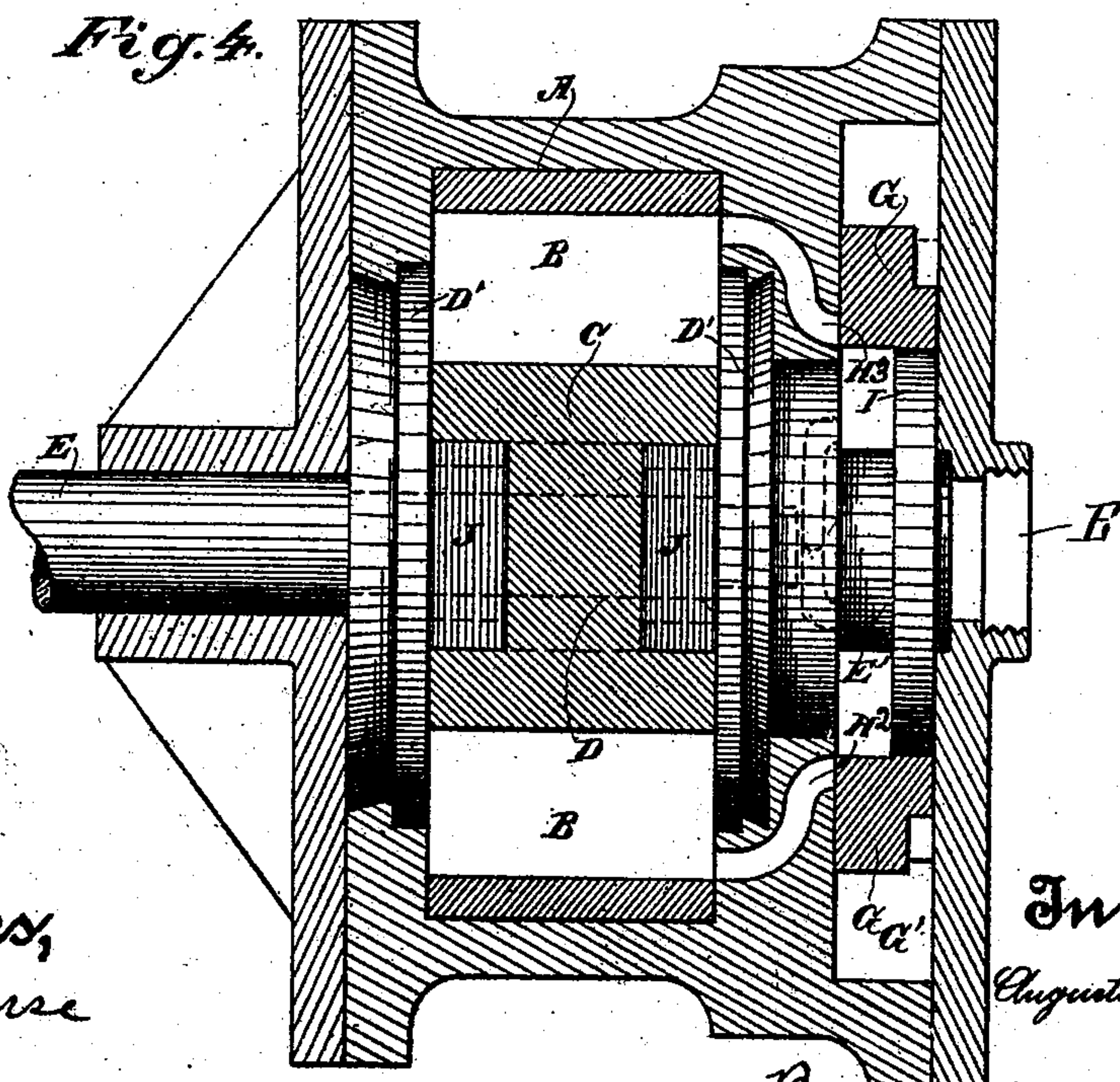
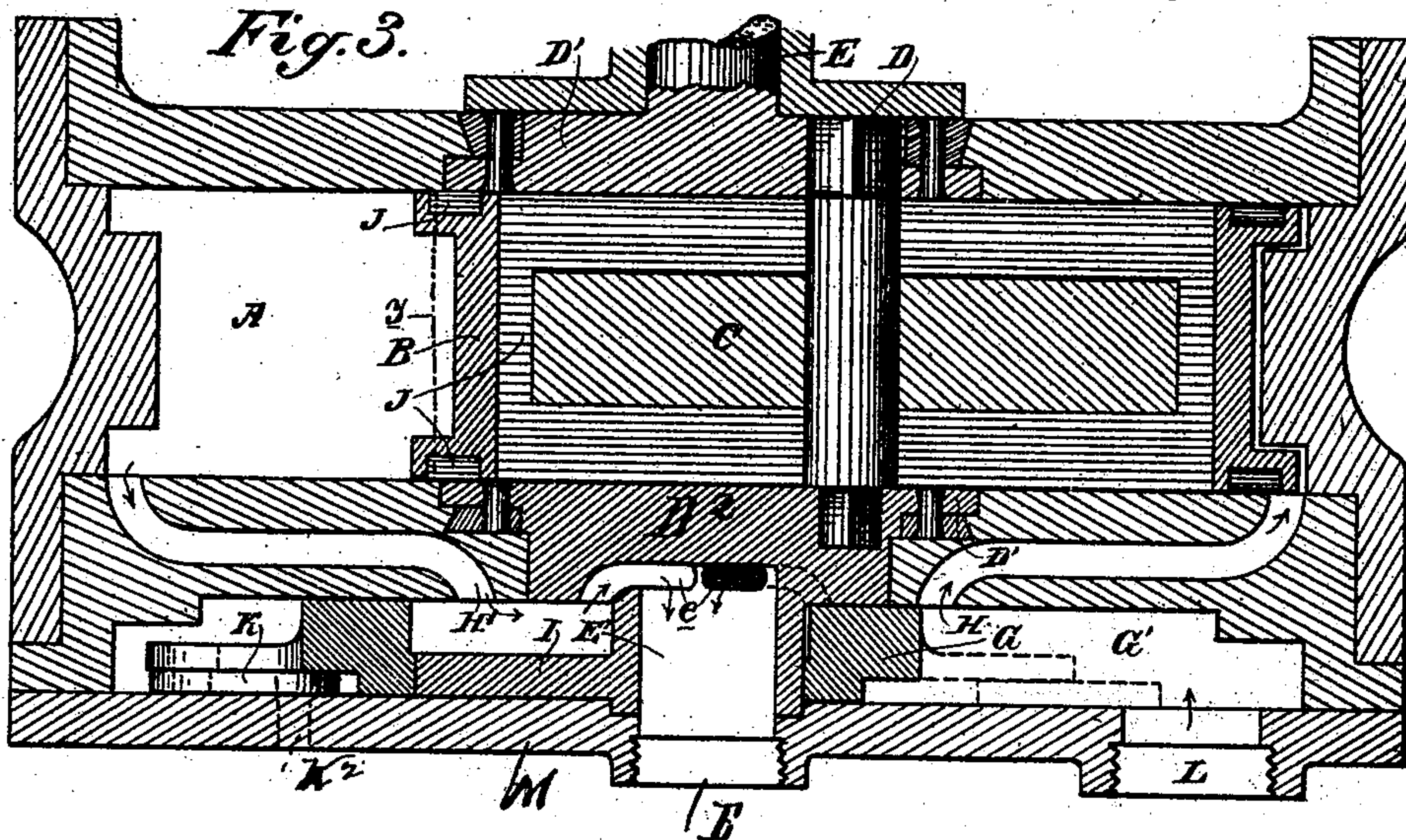
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STEAM ENGINE.

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Patented July 18, 1893.



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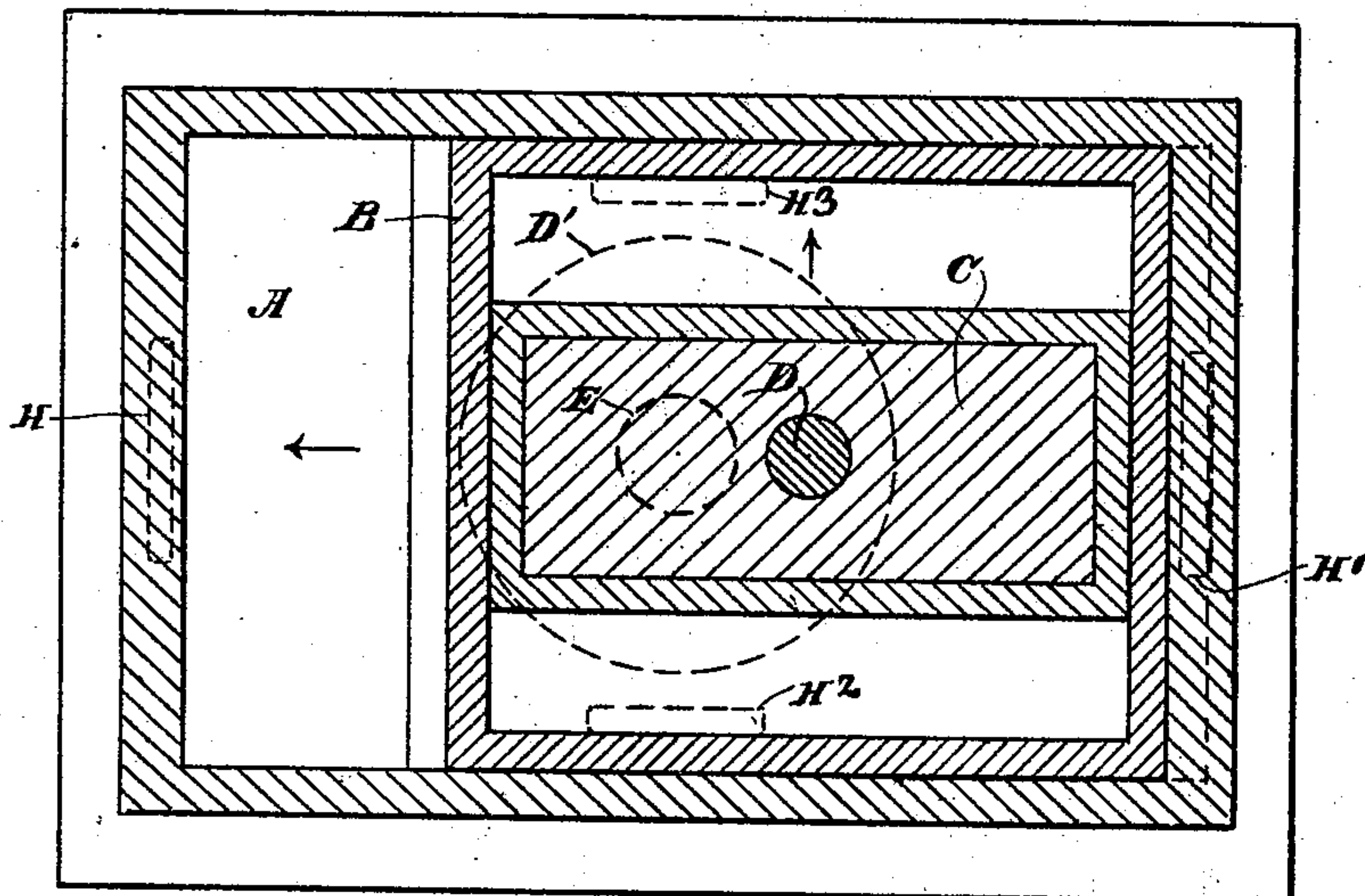
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Fig. 5.



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UNITED STATES PATENT OFFICE.

AUGUSTUS KNUDSEN, OF SAN FRANCISCO, CALIFORNIA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 501,793, dated July 18, 1893.

Application filed October 13, 1892. Serial No. 448,771. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTUS KNUDSEN, a citizen of Chili, residing in the city and county of San Francisco, State of California, have invented an Improvement in Steam-Engines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to a novel construction for engines propelled by steam or other vapor, or air, or gas under pressure.

It consists of an arrangement of transversely reciprocating pistons, one moving within another, and the exterior one within a correspondingly shaped case, valves by which the propelling medium is admitted alternately at opposite ends of the pistons, and a crank and crank shaft through which the reciprocal motion is converted into a rotary motion, and in certain details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1— is a front view of my engine, the front plate being removed. Fig. 2— is a cross section through y Fig. 3 showing two forms of packing. Fig. 3— is a longitudinal horizontal section. Fig. 4— is a transverse vertical cross section. Fig. 5 is a horizontal sectional view.

In the construction of my improved steam engine I employ an outer casing of rectangular form, within which are located reciprocating pistons of similar form, one adapted to move in the casing, and the other to move in the first piston which is made hollow for the purpose as more fully hereinafter specified.

Referring to the drawings, A, indicates the outer casing of the engine the said casing being rectangular in shape as shown. Within said casing is arranged a rectangular reciprocating piston B, which is hollow and within said piston a piston C is arranged to reciprocate at right angles to the plane of motion of the piston B.

D is the crank which is formed either by a pin fixed upon a circular disk D', or a pin supported between two such disks D' which respectively bear and revolve on the two opposite sides of the outer casing, the inner surfaces of the disks being flush with the corresponding faces of the piston B. The shaft E extends outwardly from the centers of the revolving disks and serves to transmit power

developed by the engine, and also carry eccentrics or cams by which the valves are moved.

Steam is admitted by means of a valve G moving in a steam chest G' which performs a circular translation over the ports H' H² H³ by connection with an eccentric I, or from a pin fixed in the crank cheek.

K, K are radius links connected with opposite angles of the valve, and pivoted at K² to the cover M and by this means the parallelism of the edges of the valve is maintained, during its movements.

L is the admission passages to the steam chest, and E' the exhaust. The respective pistons, being arranged to move in planes at right angles to each other it is evident that the wrist pin on the piston which drives the crank shaft of the engine, will give said shaft a rotary motion.

It will be manifest that steam may be used independently in each of the pistons, or, if desired, they may be used as compound engines, one of the pistons working steam at high pressure, and delivering it to be used in the other piston at a lower pressure, and the proportions of the outer casing and pistons will be made to suit any required demand, but to reduce parts and avoid complication, it is preferable to employ two of these engines, properly connected so that the steam from one may be used expansively in the other, either with or without the intermediate piston as it is usually employed. In this case the engines should be placed with reference to each other that the strokes will be distributed symmetrically about the center of rotation. The packing of these pistons is made of metallic strips of steel or cast iron J, which are of a shape suited to meet the conditions of flexure, and they are slightly curved outward, as shown, so that when forced into the receivers, an amount of pressure which can be properly calculated, will be exerted against the walls thereof both by the reactions of flexure and by the compression within the elastic limit produced at the angles, by the straightening of the packing.

In order to allow for expansion of the parts in a jointed packing, I have shown the packing strips united on the sides by tongue and groove joints which will permit a movement of the parts upon each other without leakage.

It will be manifest that several of these pistons, with their corresponding reciprocations, may be arranged one within the other with a suitable arrangement of valves, whereby steam is either transmitted directly to each other, or from one to the other expansively, but the figures which I have here shown illustrate the operation of two, which would be repeated in any additional number, and I do not show or claim any special mechanical construction to be used in such a multiplication, because it is within the mechanical skill of any one skilled in the art, and also because it is preferable to connect a series of engines, than to place them all in one casing.

The disk D^2 which is opposite the piston C has a passage E' extending outward as shown in Fig. 3, and is journaled in the cover M of the steam chest, said cover having a corresponding hole which forms the continuation of the passage E' and thus allows an exit for the exhaust into the air. Around this center E' is formed the eccentric I which turns in a depression or channel in the front wall of the valve G and gives the valve a rotary motion. The link connections K retain the valve in its proper position and cause it to move around its center of rotation, and uncover in its travel the different ports. The center E' is also provided with ports as shown at e , Fig. 3, through which communication is established with the interior of the valve. Commencing with the passage of the steam through L into the steam chest, the valve G first opens the port H and closes ports H^2 and H^3 , as shown in Figs. 1 and 4; consequently the piston B

will be moved to the left, while the piston C is exactly in the center of the piston B, and port H' being connected through the interior of the valve G, as shown in Fig. 3, will exhaust through the openings e into the passage E' and out into the air. A still further movement of the eccentric in the direction of the arrow (Fig. 1) will uncover port H^3 , within the valve, and allow said port to exhaust, while port H^2 being now outside of valve G, will take steam and drive piston C upward.

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

In an engine, an exterior casing, a hollow piston reciprocating therein, a second piston reciprocating within the first one, transversely to its line of motion, a shaft and a crank pin connected with both of said pistons, a steam chest with ports for the admission of steam alternately to opposite ends of the piston chambers, a rectangular valve movable over said ports, an eccentric or cam upon which the valve is mounted whereby the valve receives a movement of circular translation over the ports, and radius links connected with opposite angles of the valve, whereby the edges of the valve maintain their parallelism during its movements, substantially as herein described.

In witness whereof I have hereunto set my hand.

AUGUSTUS KNUDSEN.

Witnesses:

S. H. NOURSE,
J. A. BAYLESS.