

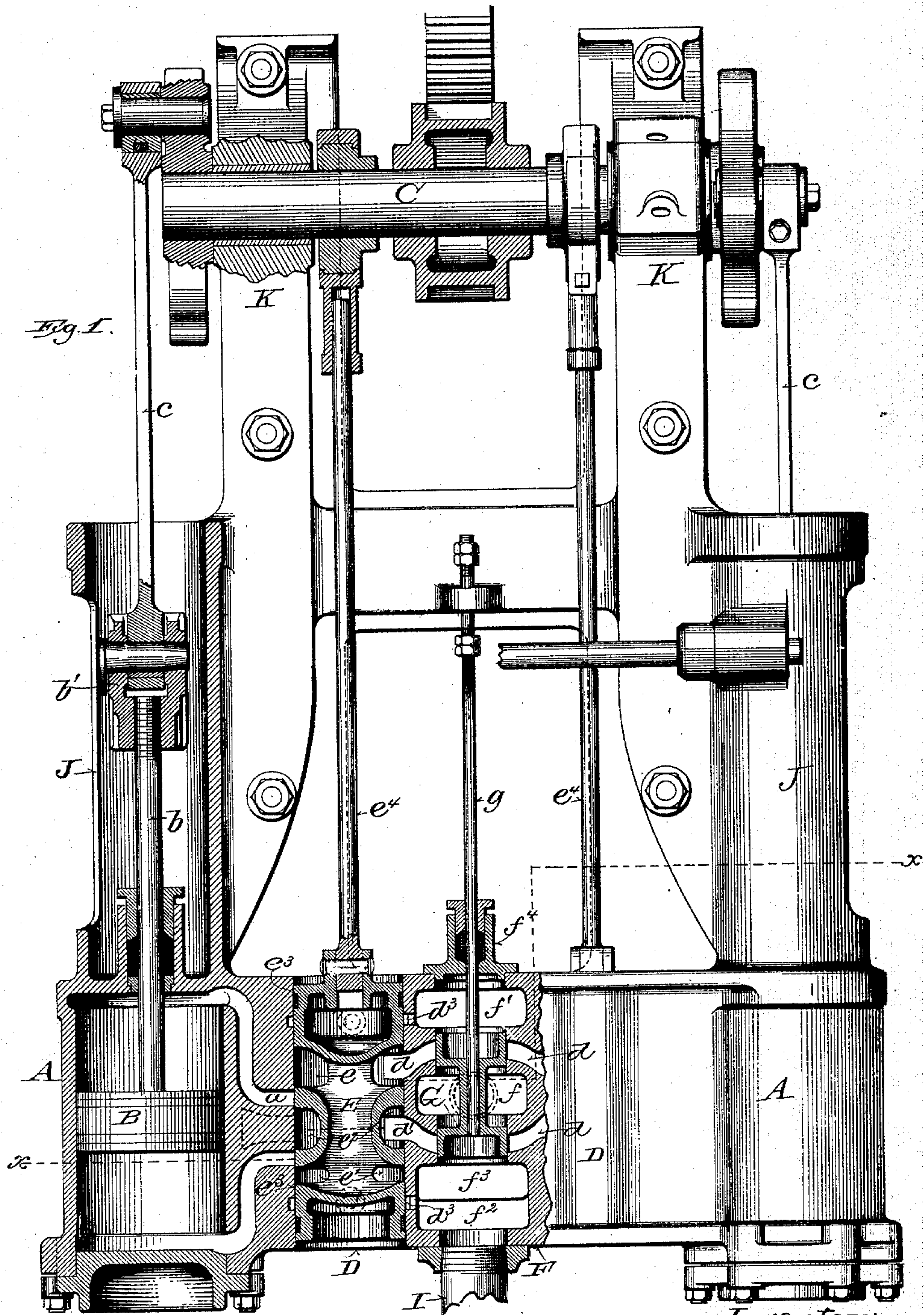
(No Model.)

2 Sheets—Sheet 1.

M. A. BECK.  
STEAM ENGINE.

No. 483,127.

Patented Sept. 27, 1892.



Witnesses:  
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Inventor:  
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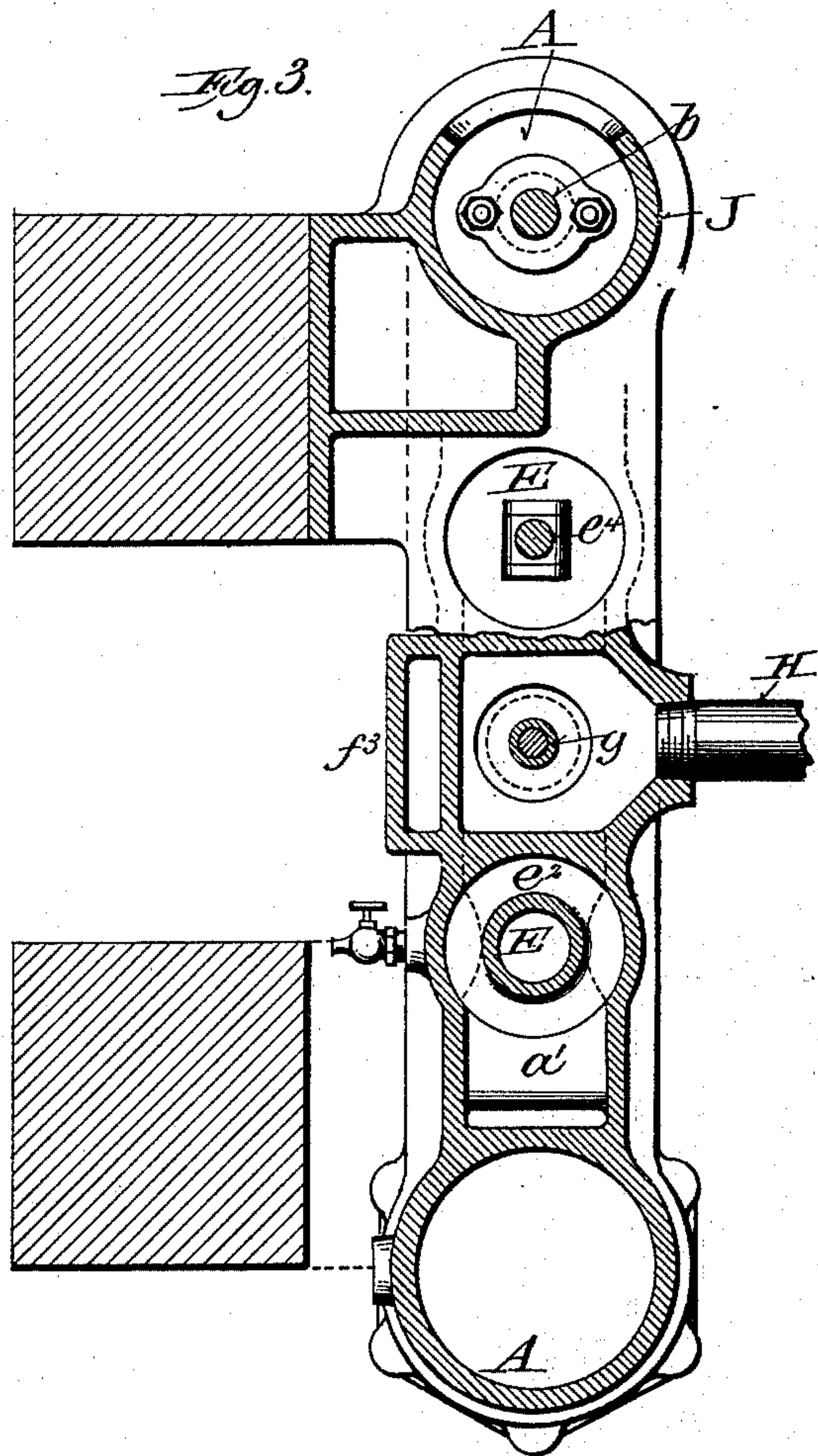
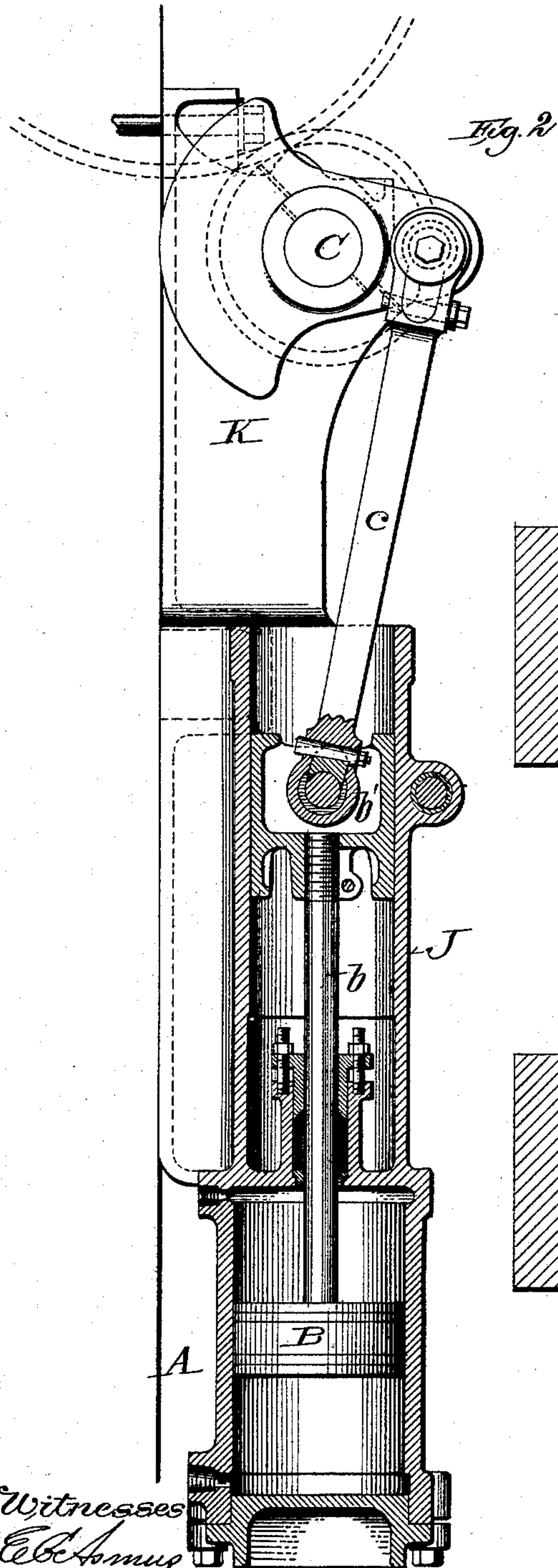
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# UNITED STATES PATENT OFFICE.

MATTHIAS A. BECK, OF MILWAUKEE, WISCONSIN.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 483,127, dated September 27, 1892.

Application filed May 7, 1891. Serial No. 391,920½. (No model.)

*To all whom it may concern:*

Be it known that I, MATTHIAS A. BECK, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The main objects of my invention are to economize steam by reducing the length of steam-passages to a minimum, to avoid condensation by dispensing with large steam-chests, to guide and to hold the valve in proper position, to avoid undue wear of the valve-faces, to reduce the labor and cost of construction by providing a design for an engine which may be produced and finished in all essential parts by boring operations, and to avoid leakage past the ends of the valves.

It consists of certain peculiarities of construction and arrangement hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like letters designate the same parts in the several figures.

Figure 1 represents a plan view or side elevation and partial axial section of a twin-cylinder engine embodying my improvements. Fig. 2 is an axial section taken through one of the cylinders in a plane at right angles to that of the section shown in Fig. 1; and Fig. 3 is a cross-section on the line  $x x$ , Fig. 1.

A represents the cylinders, B the pistons,  $b$  the piston-rods,  $b'$  the cross-heads, C the crank-shaft, and  $c$  the connecting-rods, which *per se* may be of the usual or any suitable form and construction.

D are the main-valve cases, which are made of cylindrical form inside, and E are the main valves made to fit within said valve-cases.

F is the case of the reversing-valve, and G the reversing-valve.

Inasmuch as the cylinders and main-valve cases on both sides of the engine are duplicates of each other, it will be found sufficient to describe in detail one of each only. Each

cylinder is formed or provided with steam-passages  $a a'$ , leading from the adjacent valve-case to opposite ends of the cylinder. The main valve E is formed with two connected passages  $e e'$  and with an intermediate and separate annular passage  $e^2$ , and is closed at the ends just outside of the passages  $e e'$  and formed with extended bearing-faces  $e^3 e^3$ , which bear in the ends of the valve-case D outside of the steam-ports opening into the same. By means of these extended bearing-surfaces the valve-faces proper between the passages  $e, e'$ , and  $e^2$ , opening at the periphery of the valve are accurately held and guided in their proper position, and wear thereof and of the interior surface of the valve-case adjacent to the ports is avoided and leakage thus prevented. The extended bearing-surfaces at the ends of the valve E may be provided, as shown, with any suitable kind of packing to insure close steam-tight joints between them and the valve-case. The reversing-valve case F is formed at or near the middle with a chamber or cavity  $f$ , with which the steam-pipe H is connected, and at the ends with chambers  $f'$  and  $f^2$ , which are connected with each other by a passage  $f^3$ , extending along one side of the case.

I is the exhaust-pipe connected with the valve-case F and opening out of the chamber  $f^2$ . The reversing-valve G, which consists of two connected cylindrical heads, is fitted to and works within a cylindrical bore in the partitions separating the chambers  $f, f'$ , and  $f^2$ . Between these chambers passages  $d d'$  are formed between said bore and the main-valve cases, opening into the latter on the opposite side from the passages  $a a'$  and alternating therewith. In its central position, as shown in Fig. 1, the valve G closes the openings of both passages  $d d'$  into the valve-case F and cuts off communication between the main valves and the steam and exhaust connections. When shifted sufficiently in either direction, communication is established between the chamber  $f$  and one of the passages  $d$  and  $d'$ , leading into the main-valve chamber, and between one of the chambers  $f'$  and  $f^2$  and the other passage. The main valves E are connected by rods  $e^4$  with eccentrics on the crank-shaft, and the reversing-valve G is provided with a stem  $g$ , which



passes through a stuffing-box  $f^4$  in one end of the valve-case F and is connected with suitable mechanism (not shown) for shifting the same. The main-valve cases D are formed on the inside adjacent to the guiding-faces  $e^3$ , at the ends of the valves E, with annular grooves  $d^3$ , which open into the adjacent chambers  $f'$  and  $f^2$  in communication with the exhaust-pipe I. By this means any water formed by condensation in the main-valve chambers and finding its way into said grooves is disposed of without passing into the cylinders of the engine or past the ends of the valves.

I do not wish to be understood as limiting myself to the application of my improved valve to engines of the type shown, inasmuch as they may be employed to advantage in place of the ordinary slide-valves in non-reversing single-cylinder engines or engines of other kinds by forming an exhaust-port in the cylinder between the steam-ports, as indicated by dotted lines at the left hand of Fig. 1. The location of the ports in the main valve-cylinder may also be changed within the scope of my invention, the steam passages and ports in the valve being changed accordingly.

In the construction of the engine herein shown and described, which is particularly designed for steam feed and hoisting purposes, the cylinders, valve-cases, guides, and bearing-supports for the crank-shaft are all cast together. In this way the adjustment of the several parts is preserved and a simple, strong, and durable construction is secured and the setting up and adjustment of the engine is facilitated, in addition to the advantages hereinbefore mentioned.

My improved engine, as shown in the drawings, operates as follows: When the valve G is raised or carried toward the crank-shaft, communication is established between the steam-chamber  $f$  and the passages  $d$  and between the passages  $d'$  and the exhaust-chamber  $f^2$ . Steam is thus admitted through the connected passages  $e e'$  of the main valves and alternately through the passages  $a a'$  into opposite ends of the cylinders A, the passages  $a a'$ , communicating alternately with the connected passages  $e e'$ , serving under the conditions mentioned as steam passages and with the passages  $e^3$  serving under the same conditions as exhaust-passages. When the valve G is brought to its middle position, steam is cut off from the cylinders and the movement of the engine is arrested. By depressing the reversing-valve or moving it away from the crank-shaft the movement of the engine is reversed, communication being thus established between the steam-chamber  $f$  and the passages  $d'$  through the main-valve passages  $e^3$ , now serving as steam-passages, thence alternately through the passages  $a a'$  to opposite ends of the cylinders, the connected passages  $e e'$ , now serving as exhaust-passages, communicating through the pas-

sages  $d d'$  with the exhaust-chamber  $f'$ , whence the exhaust-steam finds its way through the passage  $f^3$  to the chamber  $f^2$  at the opposite end of the valve-case F, with which the exhaust-pipe I is connected.

It will be observed that by the construction and arrangement of the main valves hereinbefore described steam is not admitted into the ends of the valve-cases D. Hence the ordinary covers, bolted joints, and gaskets may be dispensed with. It will also be observed that the ends of the reversing-valve case F are exposed only to the pressure of exhaust-steam, and consequently less care in fitting and packing the covers, stuffing-box, and exhaust connections is required. The length of steam-passages and size of the steam-chambers in the valves and valve-cases, into which live steam is admitted, are reduced to a minimum, thereby effecting a great saving of steam in reversing the engine and also avoiding waste by condensation. The valves and valve-cases being cylindrical in form are produced and finished by boring operations, thereby effecting a saving of labor and cost in their construction, the main valves being provided with extended bearing-surfaces outside of the ports and passages in the valve-cases, and the valves themselves are accurately held and guided in their proper positions, and wear on the valve-faces proper is thereby reduced.

I claim—

1. In a steam-engine, the combination, with the cylinder and piston, of a reversing-valve and its case having steam and exhaust connections, a cylindrical main-valve case having ports in one side connected by steam-passages with opposite ends of the cylinder and two ports in another side connected with the reversing-valve chamber, and a cylindrical valve fitting within said case and having steam-passages arranged to register with the ports therein and closed ends outside of said ports and passages, whereby economy of steam is effected in the operation of the engine, substantially as and for the purposes set forth.

2. In a steam-engine, the combination, with the cylinder and piston, of a reversing-valve and its case having steam and exhaust connections, a cylindrical main-valve case having two ports connected by steam-passages with opposite ends of said cylinder and two ports communicating with the reversing-valve chamber, and a cylindrical valve having steam ports and passages arranged to register with the ports in said case and extended bearing-surfaces at the ends outside of the ports therein, whereby economy of steam is effected and wear of the valve-faces between said bearing-surfaces is avoided, substantially as and for the purposes set forth.

3. In a steam-engine, the combination, with the cylinder and piston, of a cylindrical valve-case connected with opposite ends of said cylinder by steam-passages and having suitable steam and exhaust connections, and a cylin-



dricl valve fitted within said case, having suitable passages arranged to register with the ports therein and extended bearing-surfaces outside of said ports, said valve-case  
5 being formed with annular grooves, with waste-openings near the ends adjacent to the extended bearing-surfaces of the valve, whereby leakage past the ends of the valve is prevented, substantially as and for the purposes  
10 set forth.

4. In a reversing engine, the combination, with a cylinder and piston, of a reversing-valve and its case having exhaust-chambers at the ends and an intermediate steam-chamber and passages connecting it with the main-valve chamber, a main-valve case connected by steam-passages with opposite ends of said cylinder and having at or near its ends openings into the exhaust-chambers of said reversing-valve case, and a cylindrical main valve having closed ends fitting within the main-valve case and formed with intermediate ports arranged to register with the ports in said main-valve case, substantially as and for the  
25 purposes set forth.

5. In a reversing engine, the combination, with a cylinder and piston, of cylindrical main and reversing valve cases, the main-valve case being connected with opposite ends of the cylinder and with the reversing-valve case by suitable passages, and the reversing-valve case having connected exhaust-chambers at the ends and an intermediate steam-chamber, a reversing-valve consisting of two cylindrical heads fitted to a cylindrical bore in the partitions separating said steam and exhaust chambers and controlling the passages leading through said partitions into the main-valve case, and a cylindrical main valve formed with  
30 steam-passages arranged to register with the ports in its case and having closed ends and extended bearing-faces outside of said ports, the main-valve case being formed near the ends adjacent to the extended bearing-surfaces of the valve with annular grooves which open into the exhaust-chambers at the ends of the reversing-valve case, substantially as and for the purposes set forth.

6. In a steam-engine, the combination, with  
50 the cylinder and piston, of a cylindrical valve-case connected with opposite ends of said cylinder by steam-passages and having steam and exhaust connections, a cylindrical valve formed with passages registering with the  
55 ports in said valve-case and provided with closed ends and extended bearing-surfaces outside of said ports, said bearing-surfaces being provided near the outer ends with suitable packing, and the valve-case being formed ad-

jacent to said surfaces with annular grooves  
60 having waste-openings, substantially as and for the purposes set forth.

7. In a steam-engine, the combination, with the cylinder and piston, of a reversing-valve and its case having steam and exhaust con-  
65 nections, a cylindrical main-valve case having two ports connected by passages with opposite ends of said cylinder and two opposite alternating ports in communication with the reversing-valve chamber, and a cylindrical  
70 main valve having closed ends and between them connected ports, and a separate intermediate port arranged to register with the ports in the main-valve case, substantially as and for the purposes set forth. 75

8. In a steam-engine, the combination, with two cylinders and pistons, of a reversing-valve and its case having steam and exhaust connections, two cylindrical main-valve cases, each having two ports connected by passages  
80 with opposite ends of the adjacent cylinder and two opposite and alternating ports in communication with the reversing-valve case, and cylindrical main valves having closed ends and between them connected ports, and  
85 separate intermediate ports arranged to register with the ports in said main-valve cases, substantially as and for the purposes set forth.

9. In a twin-cylinder reversing engine, the combination, with the cylinders and pistons,  
90 of cylindrical main-valve cases, each having two ports communicating with opposite ends of the adjacent cylinder, an intermediate reversing-valve case having exhaust-chambers at the ends, a steam-chamber between them,  
95 and intermediate ports connected with ports in the main-valve chambers opposite to and alternating with the ports therein, communicating with the cylinders, a reversing-valve controlling communication between the steam  
100 and exhaust connections and the passages leading from the reversing-valve chamber into the main-valve chambers, and cylindrical main valves having closed ends with extended bearing-surfaces and intermediate  
105 ports arranged to register with the ports in the main-valve cases, said main-valve cases having at or near their ends openings into the exhaust-chambers in the ends of the reversing-valve case, substantially as and for  
110 the purposes set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

MATTHIAS A. BECK.

Witnesses:

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F. C. BUDD.