

P. W. WILLANS.
MOTIVE-POWER ENGINE.

No. 176,823.

Patented May 2, 1876.

Fig: 1.

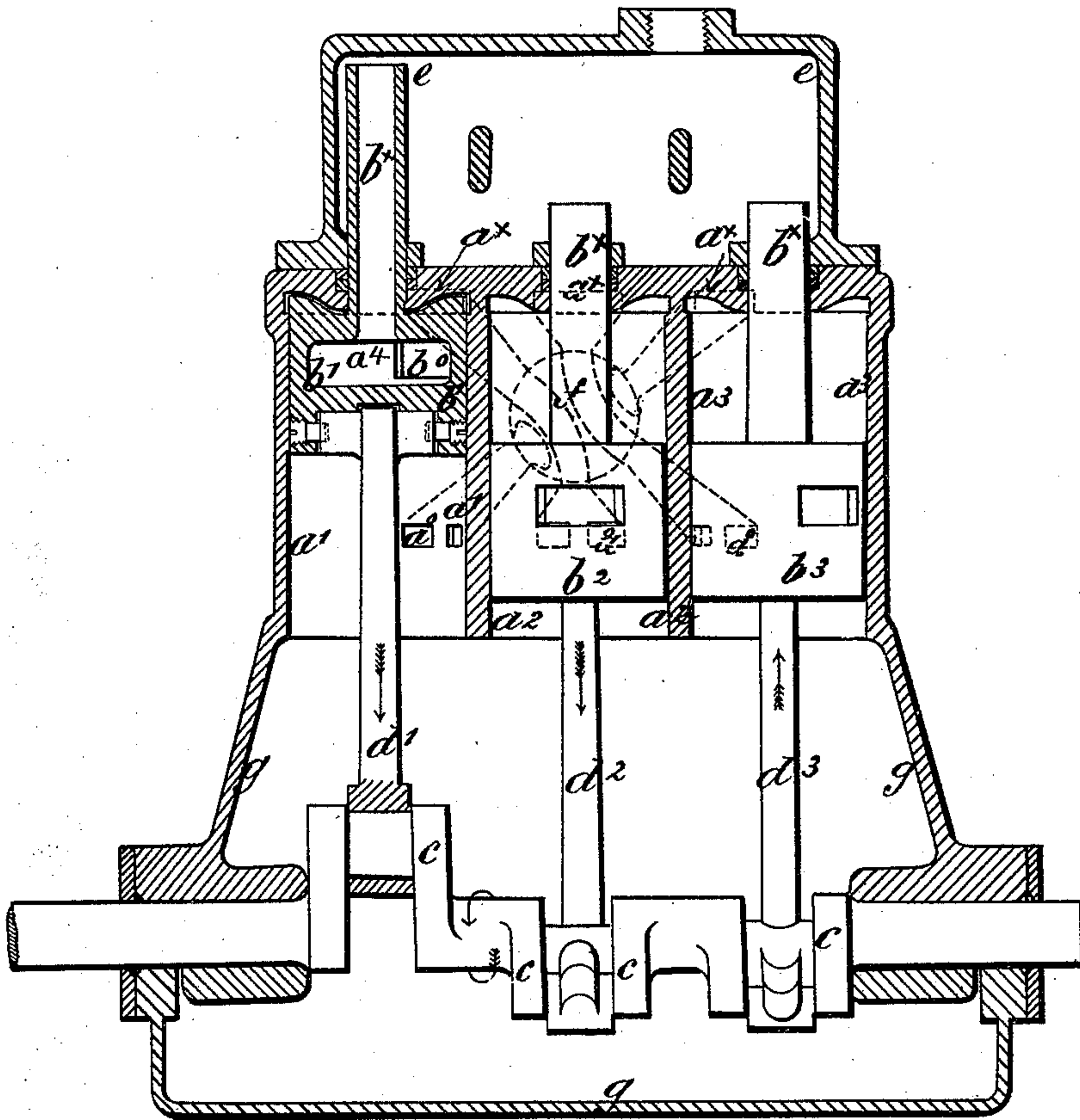
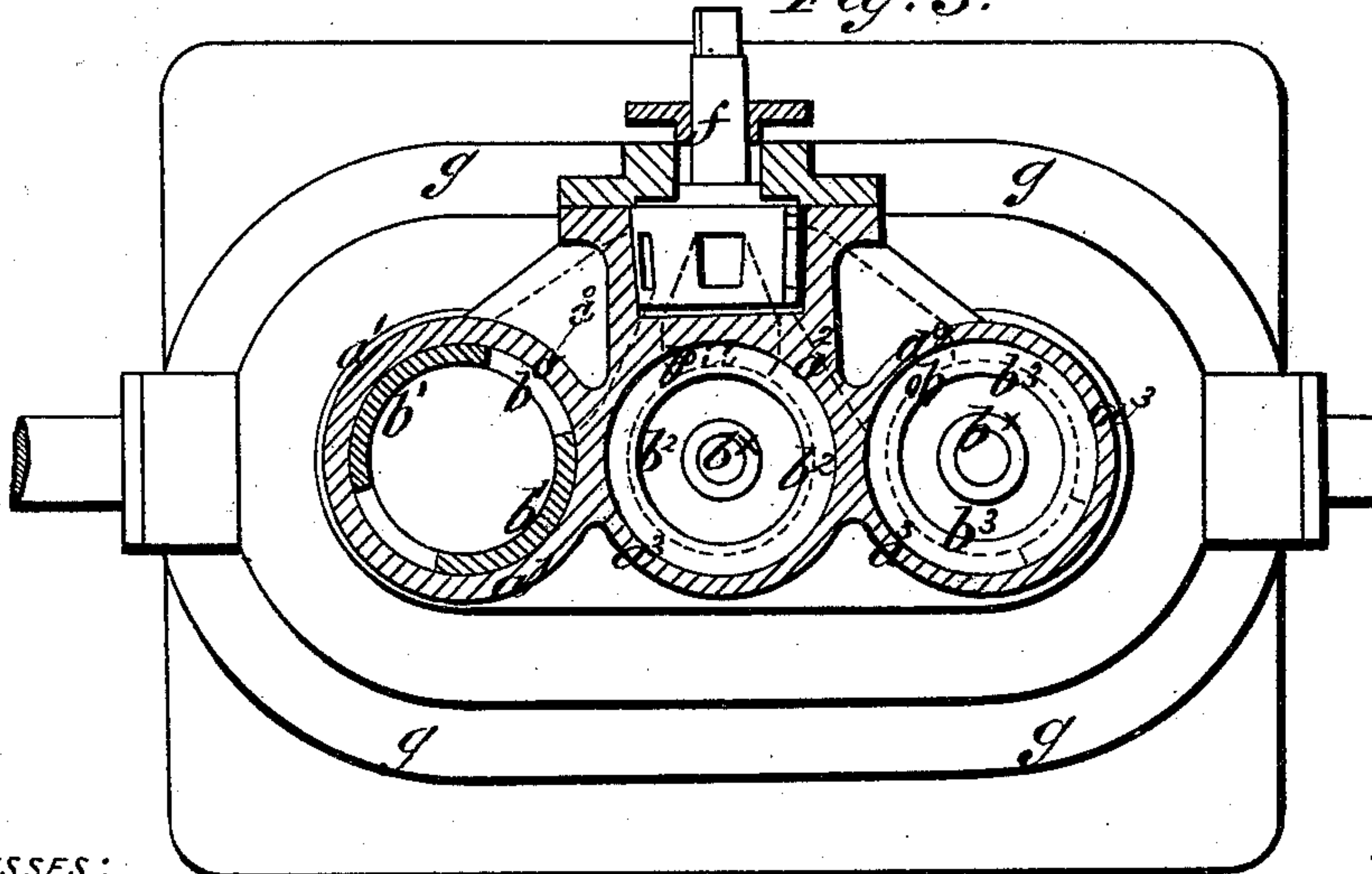


Fig: 3.



WITNESSES:

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PETER WILLIAM WILLANS

By HIS ATTORNEY

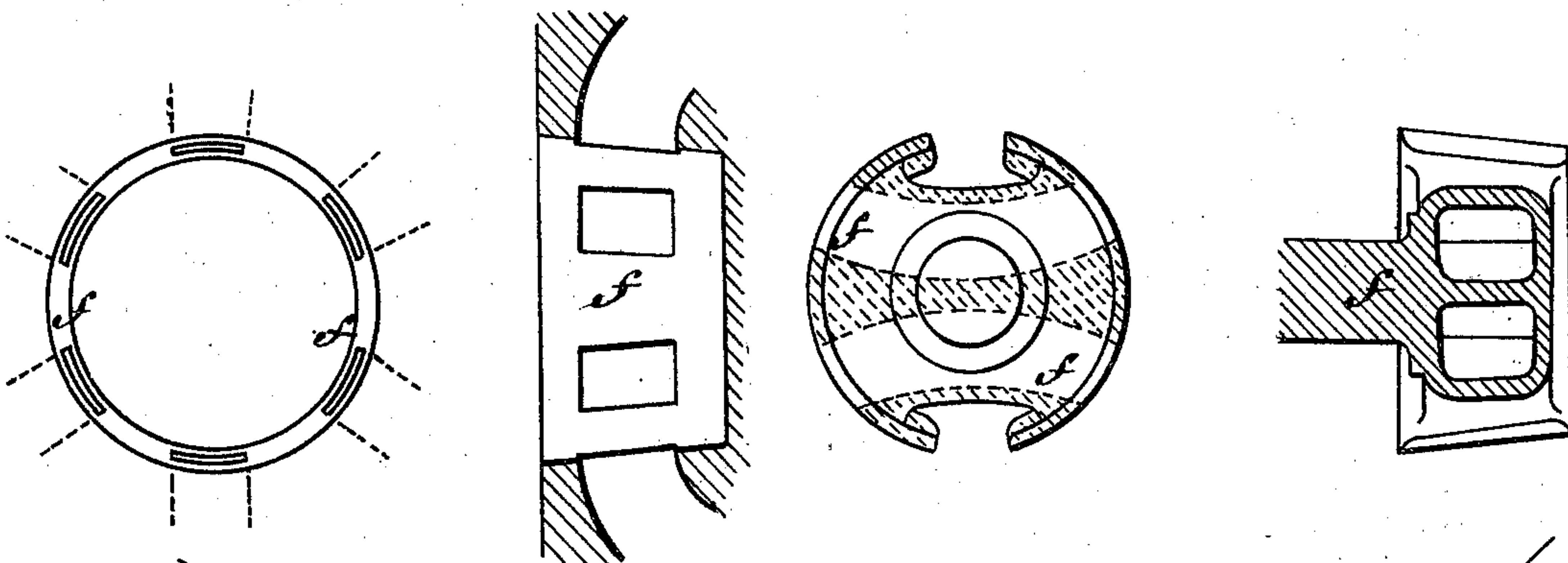
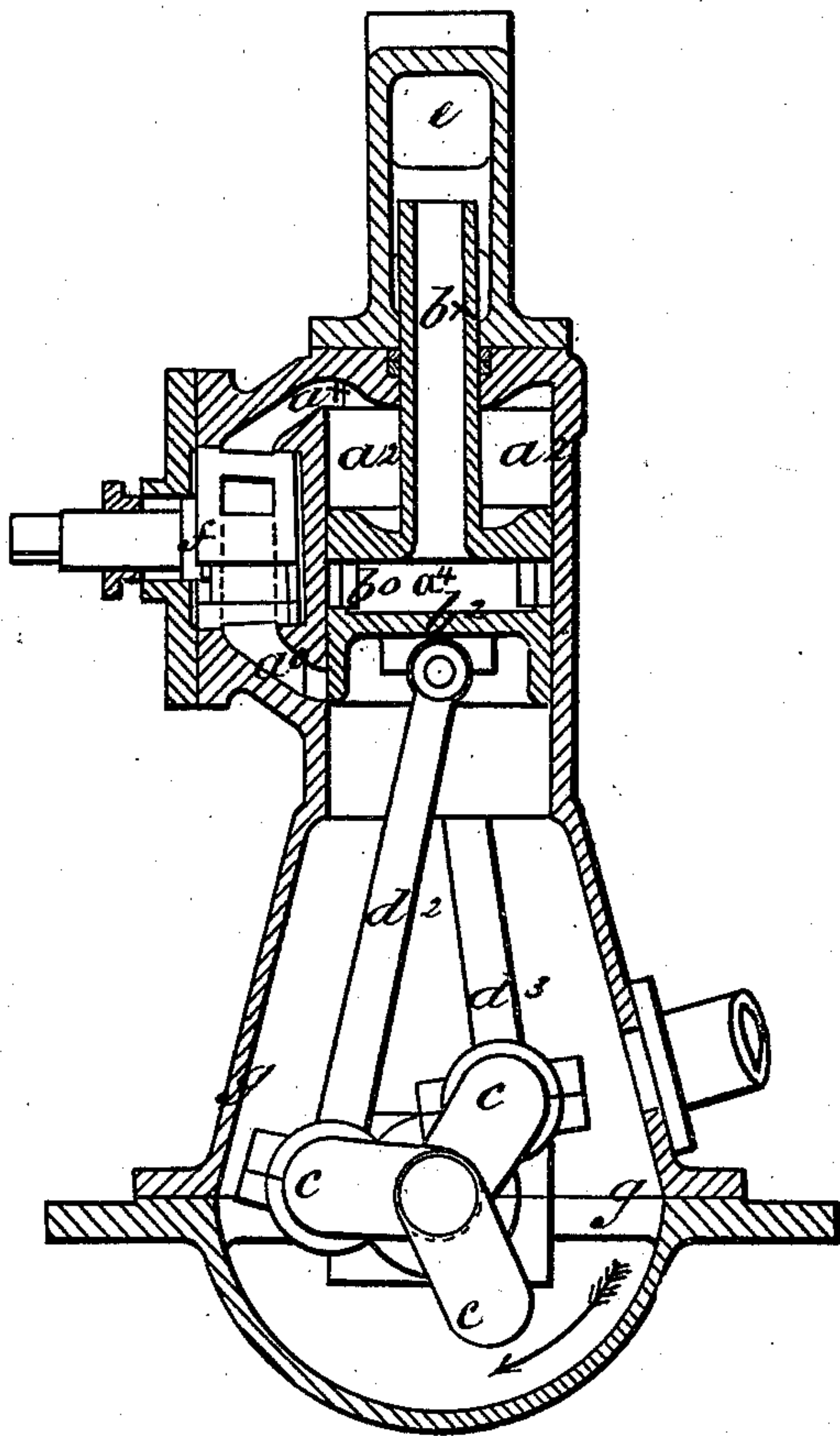
Wm. D. Baldwin

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Fig: 2.



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PETER WILLIAM WILLANS, INVENTOR
Figs: 3, 4, 5, 6. BY HIS ATTORNEY *Wm. D. Baldwin*

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Fig: 6.

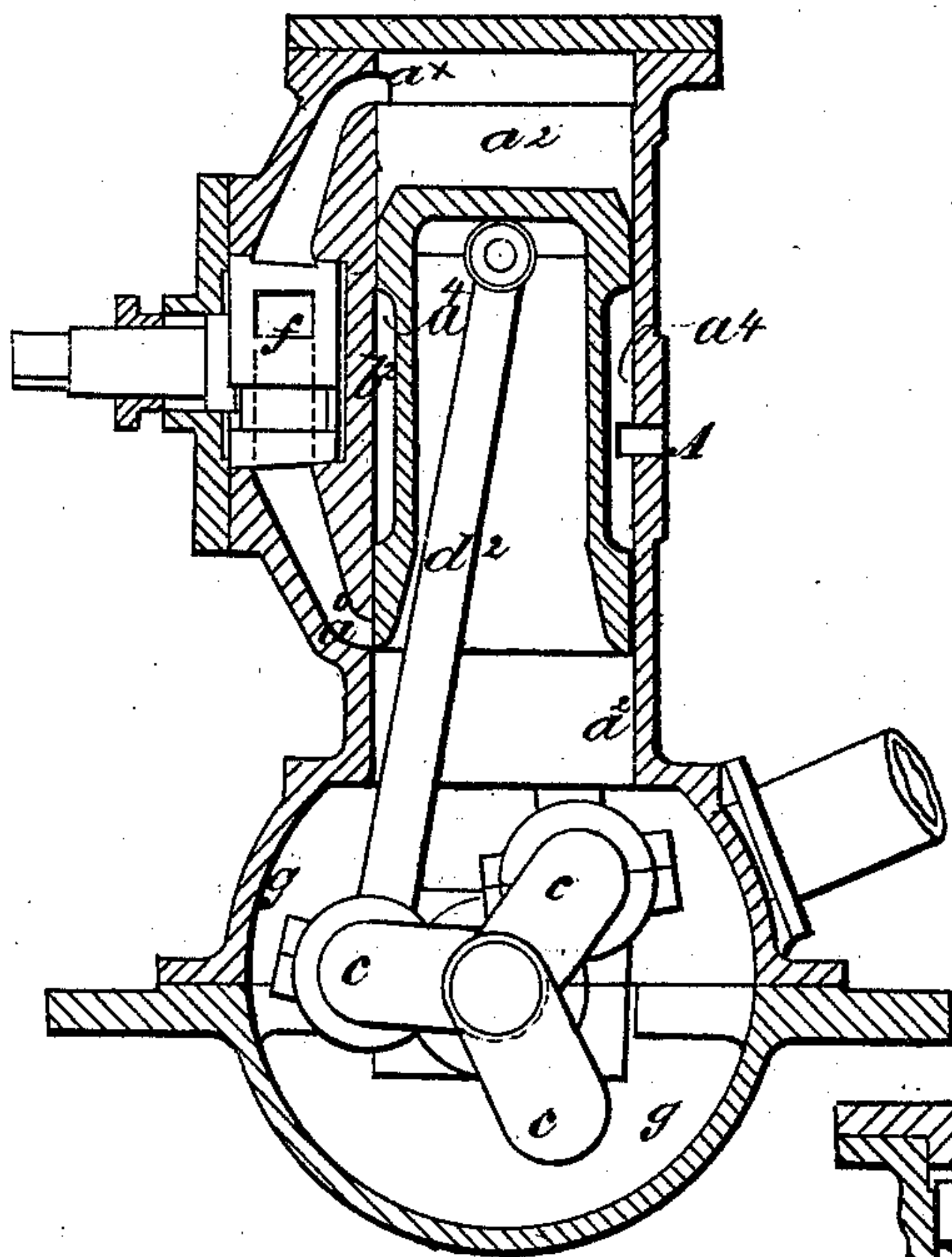


Fig: 5.

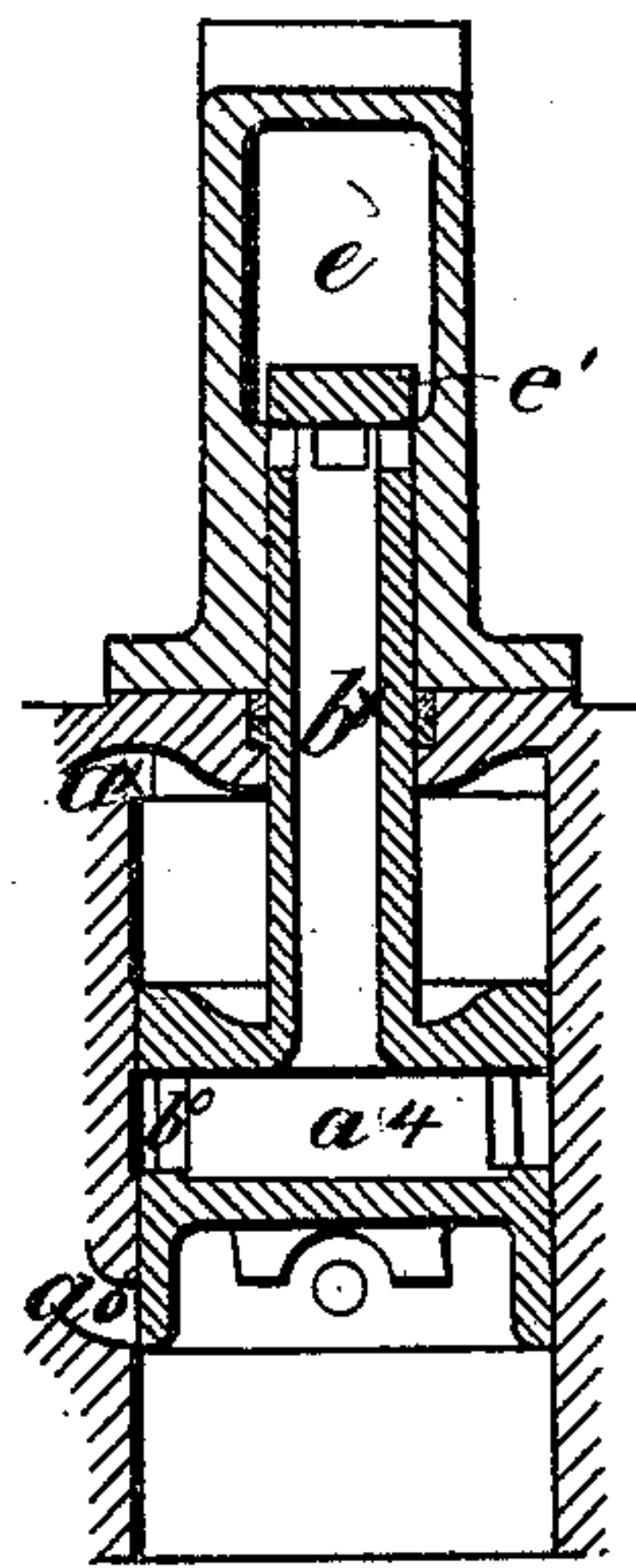
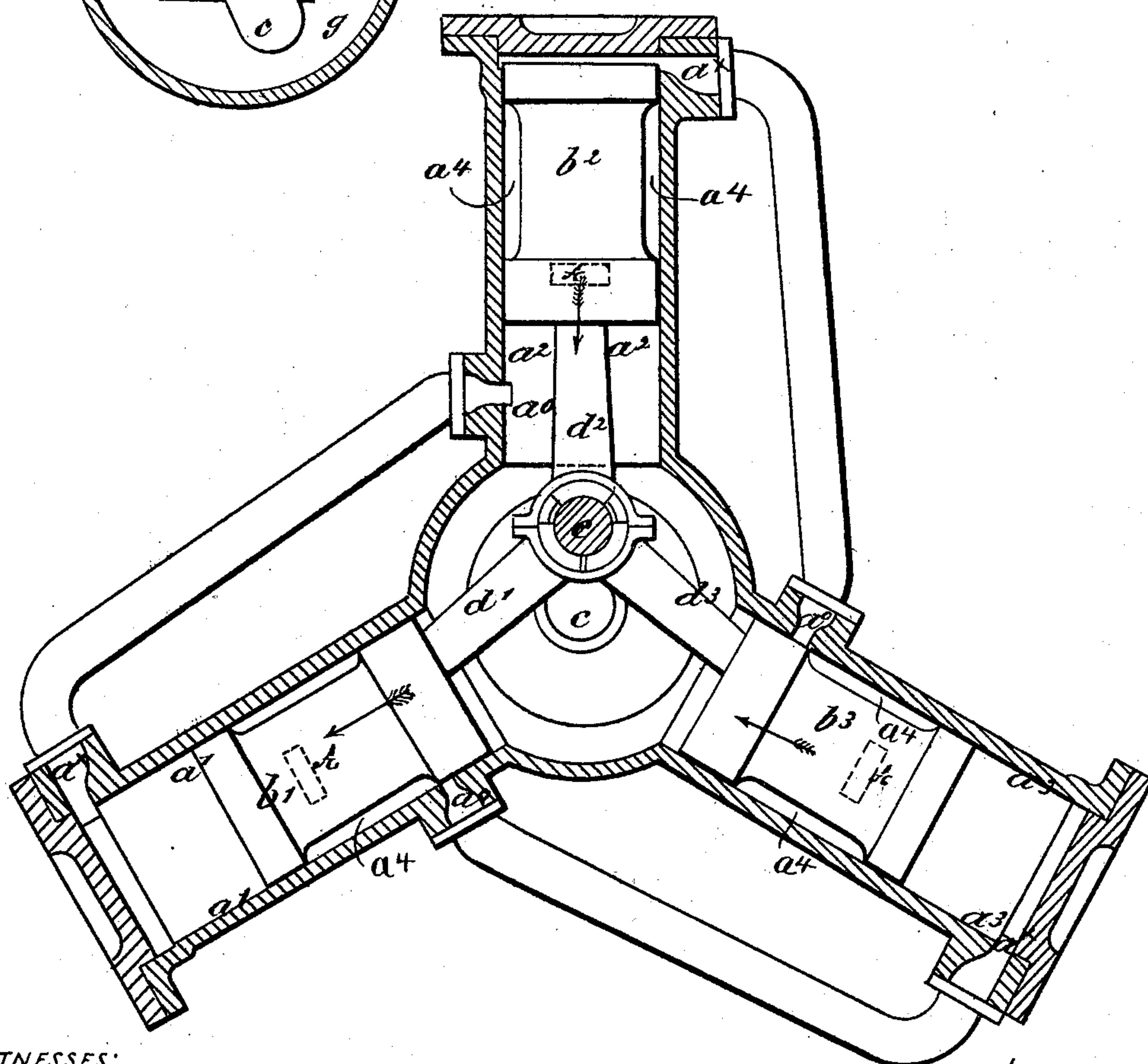


Fig: 7.



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Fig: 8.

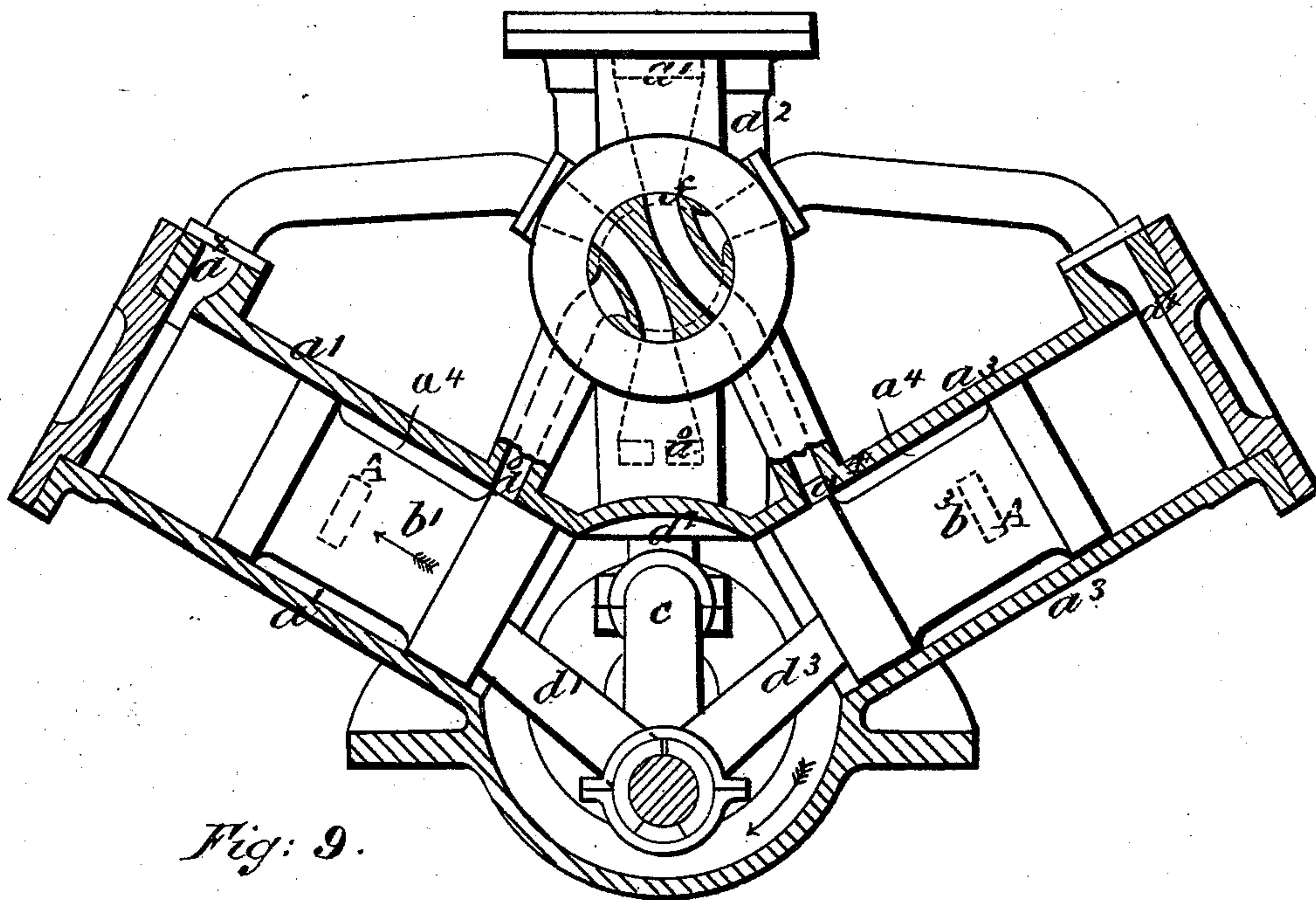
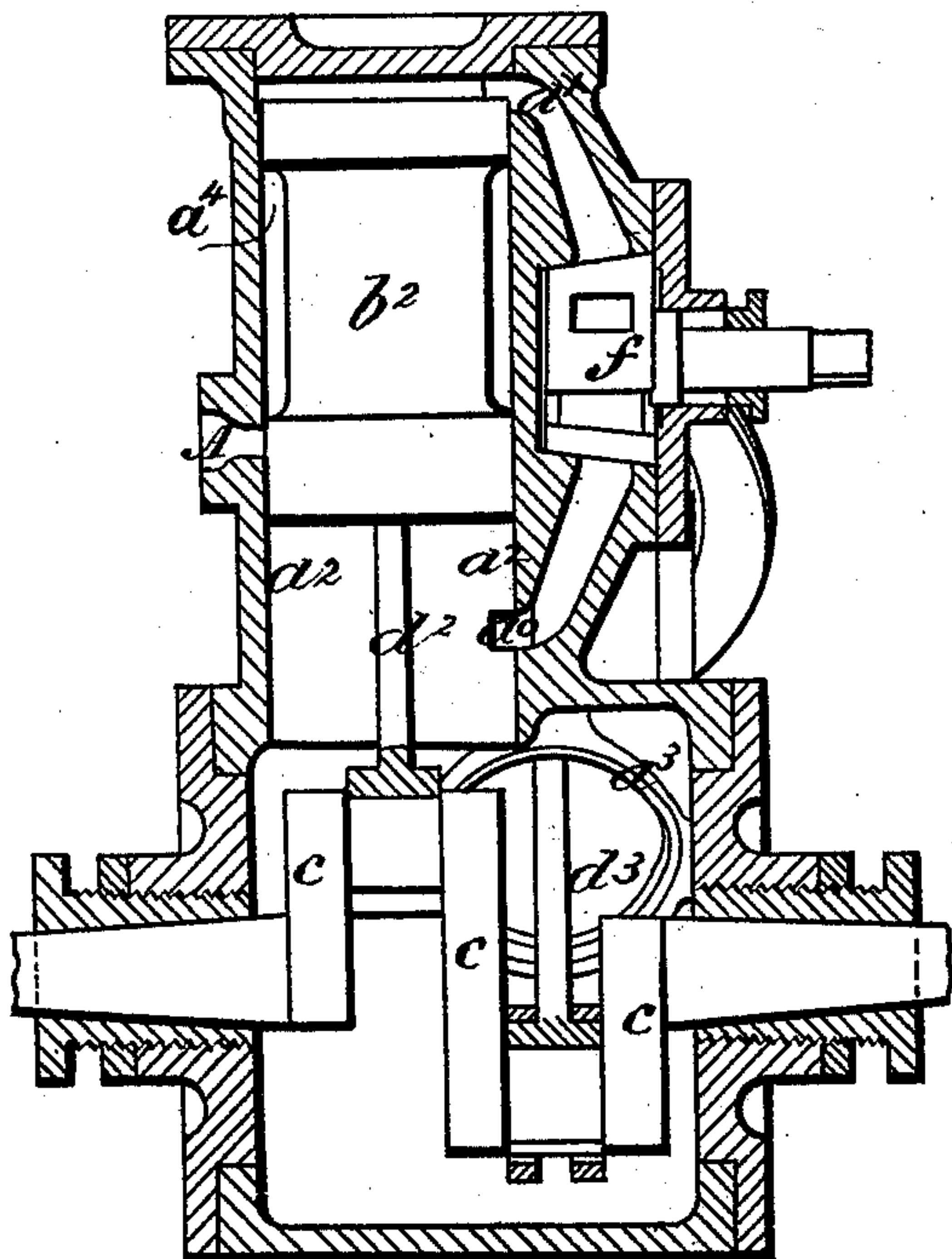


Fig: 9.



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UNITED STATES PATENT OFFICE.

PETER WILLIAM WILLANS, OF LEWISHAM, ENGLAND.

IMPROVEMENT IN MOTIVE-POWER ENGINES.

Specification forming part of Letters Patent No. 176,823, dated May 2, 1876; application filed October 22, 1875.

To all whom it may concern:

Be it known that I, PETER WILLIAM WILLANS, of 10 St. Stephen's Terrace, Lewisham, in the county of Kent, England, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in Steam or Motive Power Engines and Pumps; and I, the said PETER WILLIAM WILLANS, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say:

This invention has for its object improvements in steam or motive power engines.

In constructing a steam-engine I employ three cylinders, placed side by side. Their pistons work onto three cranks on the main shaft at angular distances of one hundred and twenty degrees the one from the other, or all the pistons may work onto one crank, the cylinders then being ranged around the crank equidistant the one from the other. Each cylinder is single acting, its piston receiving steam only on its outer side, or that farther from the crank. To the other side of the piston the connecting-rod is jointed, and it passes direct from the piston to the crank. Each piston serves as a steam-valve, and controls the supply of steam to act upon one or other of the other pistons. There is a steam-chamber in the piston, and a port in its side. Steam is supplied to the piston from the boiler, and for this purpose the piston may be provided with a hollow piston-rod, working through a gland at the outer end of the cylinder, and passing into a steam-chest. When the piston is at about three-fourths of its stroke toward the inner end of cylinder the steam-port in the piston overlaps a port formed in the side of its cylinder. The ports are then full open, and steam passes through these ports to another of the cylinders. The ports are so formed that the steam-passage remains open during rather more than one-third of the rotation of the crank, and the steam enters the cylinder supplied just before the commencement of the effective stroke, and is cut off some time before the end of the stroke. When a piston is at about one-half of its outward stroke the port in the side of the cylinder is uncovered, and

this allows the steam to pass back out of the cylinder, which the port supplies, and I arrange that the exhaust shall remain open during nearly one-half of the rotation of the crank.

The steam may escape direct into the air or into a casing through which the crank-shaft passes. This casing can, if desired, be connected with a condenser.

An important feature in the engine, not yet mentioned, is that the engine can be reversed simply by means of a cock or valve on the passages leading from cylinder to cylinder.

By means of this cock or valve the steam, after it has passed through the port of the piston of one cylinder can be directed at pleasure to either of the two other cylinders, and the direction of rotation of the engine will be forward or backward, according to the direction given to the steam by this cock or valve.

The engine may be driven by air or other fluid under pressure. If water or other liquid be used I form the piston valves and ports so as to open the supply and close the exhaust simultaneously. When the engine is driven by power applied to its crank-shaft it forms a pump. The subject-matter claimed will hereinafter specifically be designated.

In order that my said invention may be most fully understood and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

Figure 1 is a longitudinal section of an engine constructed according to my invention. Fig. 2 is a transverse section, and Fig. 3 a horizontal section, of the same.

$a^1 a^2 a^3$ are the three cylinders, and $b^1 b^2 b^3$ the pistons within them. The pistons work a three-throw crank, c , by means of connecting-rods $d^1 d^2 d^3$. e is a steam-chest on the end of the cylinders, from which steam enters freely into the chambers a^4 , formed by the interior of the pistons, which are hollow through tubular piston-rods $b^x b^x b^x$, passing through glands in the cylinder ends. There are ports $b^0 b^0 b^0$ in the sides of the pistons, and corresponding ports $a^0 a^0 a^0$ in the sides of the cylinders. When these ports correspond steam passes out by them from the steam-chest e . $a^x a^x a^x$ are other ports at the top of the cylinders, and the steam which enters the port a^0 of one cylinder issues by the port a^x of an-

other cylinder, and acts on the piston therein. The connections between the ports a^0 and a^x may be direct where it is never required to reverse the engine; but where this power is required the connections are taken through a three-way cock, f , so that the steam from the interior of the piston of one cylinder may be directed at pleasure onto the piston of either of the other cylinders.

The construction of the cock f is shown more fully and on a larger scale by the Figs. 4. The ports $a^0 a^x$, with the passages connecting them, also serve for the escape of the steam from the cylinders, when it has done its work. The ports a^0 become exhaust-ports for the cylinders, which they have just supplied, each as soon as the piston rises above it in its cylinder, and so uncovers it.

The steam escapes either direct into the atmosphere or into a chamber or casing, g , surrounding the cranks, which may or may not be connected with a condenser. Pipes for heating the feed-water may be coiled or otherwise arranged within the casing g . The tubes which bring the steam to the interior of the pistons are also useful in running the engine at high speeds, as the pressure upon them destroys the momentum of the pistons and connecting-rods in the upward and ineffective stroke.

The amount of expansion in these engines may, if desired, be varied in the manner indicated by Fig. 5. Here, as will be seen, the connection between the steam-chest e and hollow piston-rods b^x (with the cavities a^4 in the pistons, with which they communicate) is cut off before the piston-ports b^0 coincide with the cylinder-ports a^0 by means of valves e' on the ends of the piston-rods. Thus the steam to perform the stroke is, as it were, measured out before being admitted to the cylinder, and the degree of expansion will depend on the capacity given to the measuring cavities in the pistons.

Fig. 6 shows an arrangement in which the tubular piston-rods b^x , which serve to convey steam to the ports b^0 of the pistons are dispensed with, the pistons being made longer and the steam being led in through the sides of the cylinders by passages A to the steam-chambers a^4 . (Shown as formed upon the outside of the pistons.)

For some purposes a single-throw crank may be used, the cylinders being placed angularly at about one hundred and twenty degrees apart, as is shown by Fig. 7; or, where it would be inconvenient to place the cylinders all around the shaft, they may be placed at about sixty degrees apart, and made to actuate a two-throw crank, as is shown at Figs. 8 and 9, Fig. 8 being a longitudinal section, and Fig. 9 a transverse section.

As already mentioned, these engines are capable of being worked also by compressed air or other elastic fluid, or by water or other liquid, or they may be driven and worked as pumps.

From the foregoing description it will be seen that the steam or other elastic fluid is at all times admitted freely to the chambers or cavities in the pistons of all the cylinders, and passes from them to the ends of the cylinders, to act upon the pistons, through passages connecting the side port of each cylinder with the end port of another cylinder, the steam passing from or through one piston-chamber to act upon the piston of one of the other cylinders, and then exhausting into the chamber or casing g surrounding the cranks, by the same passage and ports in the cylinders by which it was admitted.

I do not broadly claim devices by which constant steam-pressure is kept on the pistons, and by means of which the connecting-rods are pressed to the shaft.

Having thus described the nature of my said invention, and the manner of performing the same, I would have it understood that I claim—

1. The combination, in three-cylinder engines, of single-acting cylinders, their pistons constructed, as described, to receive the entering fluid, connecting-rods, by which the pistons are connected directly with the crank-shaft, single passages between the cylinders acting alternately as admission and exhaust passages, and a chamber or casing surrounding the crank-shaft, and into which the cylinders open, these members being constructed and operating substantially as hereinbefore set forth, whereby the piston of one cylinder serves as the valve of another, and the fluid, after having passed from one piston to act upon another, escapes by the cylinder to the piston of which it was first admitted directly into the crank inclosing casing.

2. The combination of the cylinders, their pistons, into which the fluid enters, the single passages between the cylinders (each of which serves both as an admission and escape passage,) and the cock f , these members being constructed and operating substantially as and for the purpose set forth.

3. An engine constructed, substantially as hereinbefore set forth, with three cylinders, each having a side port and an end port, and each provided with a piston, having a chamber to which the fluid is admitted, and a port by which it escapes, with single passages, each of which serves alternately for the admission and escape of the fluid, connecting the side port of each cylinder with the end port of one of the other cylinders, whereby the fluid passes through the piston-chamber of each cylinder by the side port of the cylinder to the end port of another cylinder to act upon the piston therein, and exhausts by the same passage and cylinder-ports.

4. The combination of the fluid-chest, the cylinders, the tubular piston-rods, the pistons, the piston chambers and ports, the cylinder-ports, and the fluid-passages, these members being constructed and operating substantially as set forth.

5. The combination of the fluid-chest, the cylinder, the tubular piston-rod, the cut-off valve thereon, and the chambered piston, substantially as set forth.

inder-ports, and the valve or cock in said passages, substantially as set forth.

6. The combination of the cylinders, their side and end ports, the chambered pistons, their ports, the passages connecting the cyl-

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Witnesses:

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