

No. 620,780.

Patented Mar. 7, 1899.

D. JOY.  
VALVE GEAR.

(Application filed Nov. 21, 1898.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.

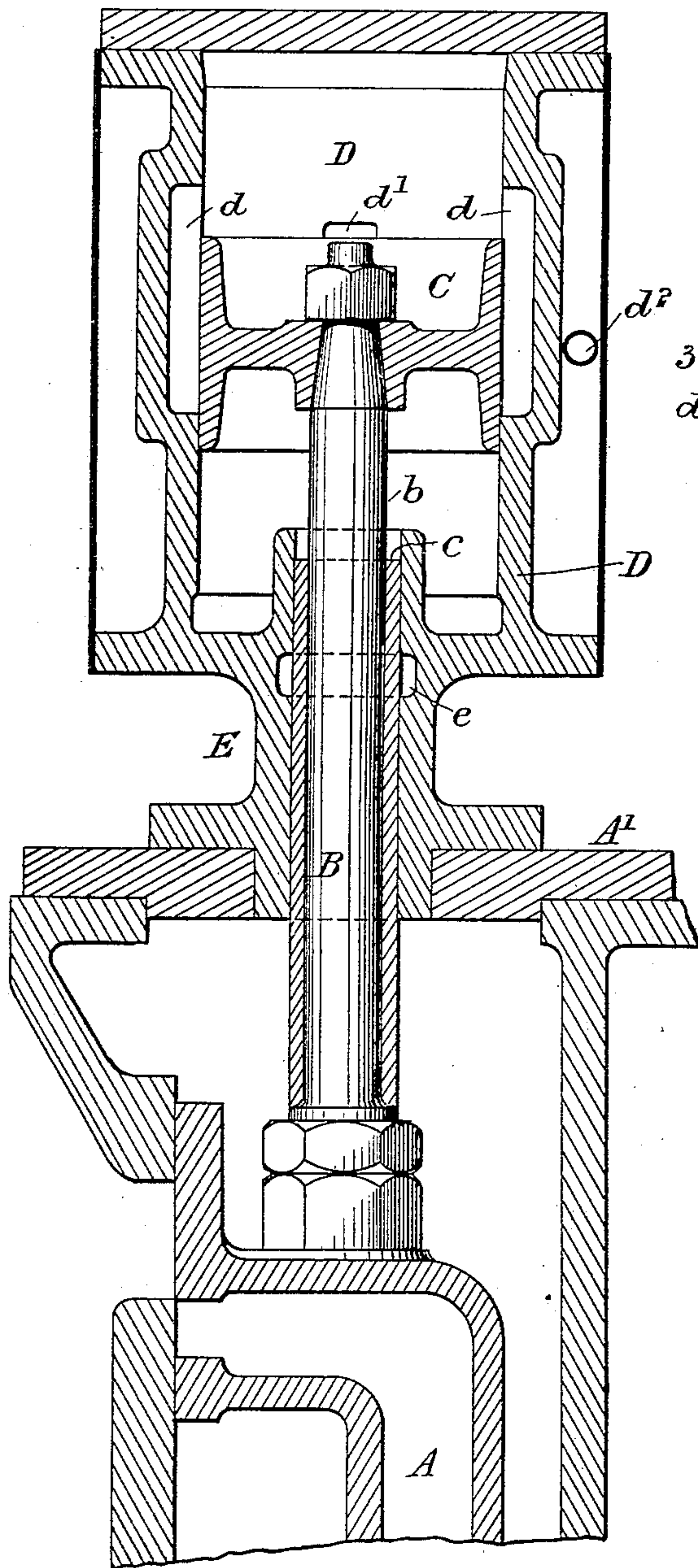


Fig. 2.

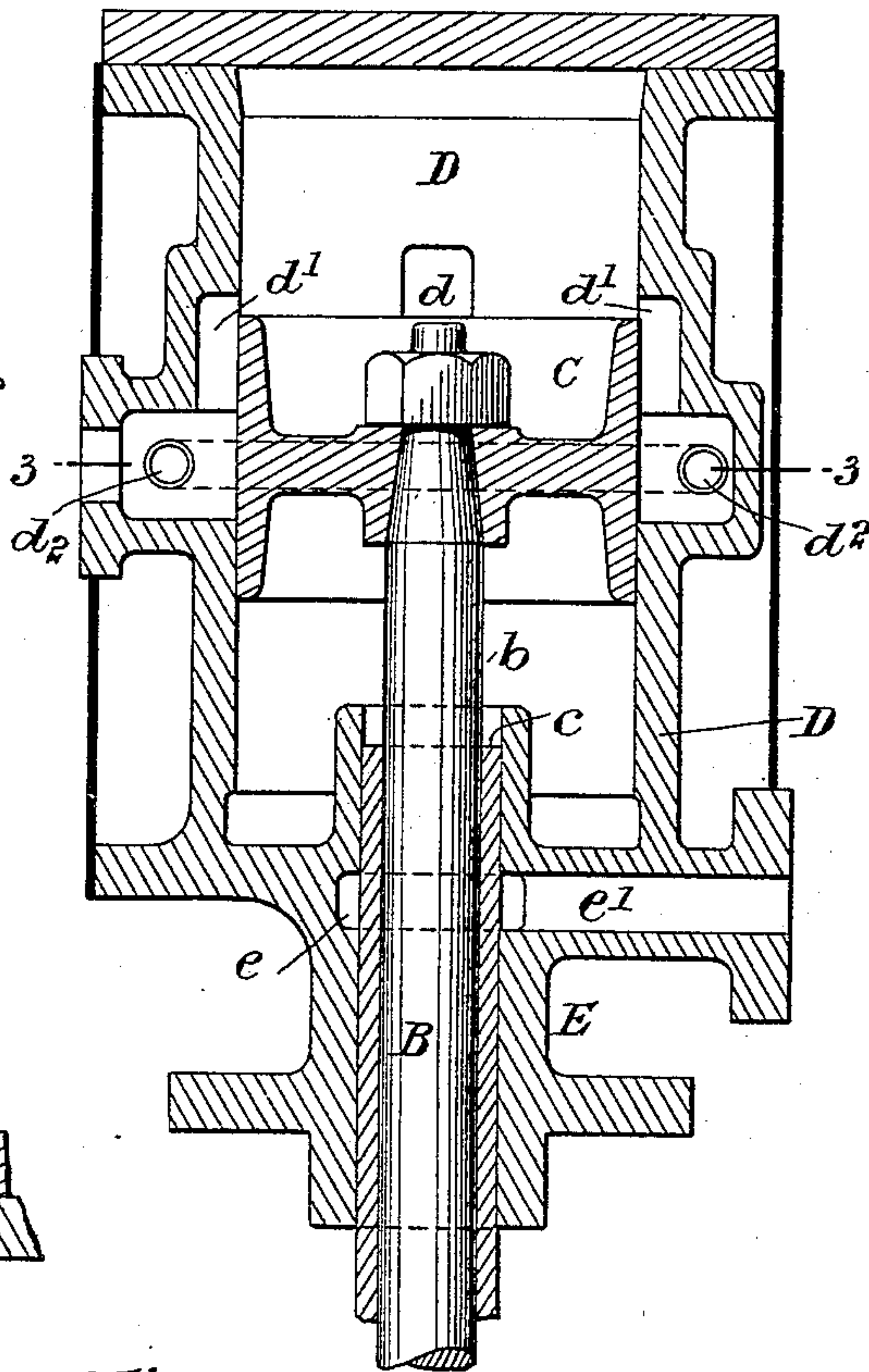
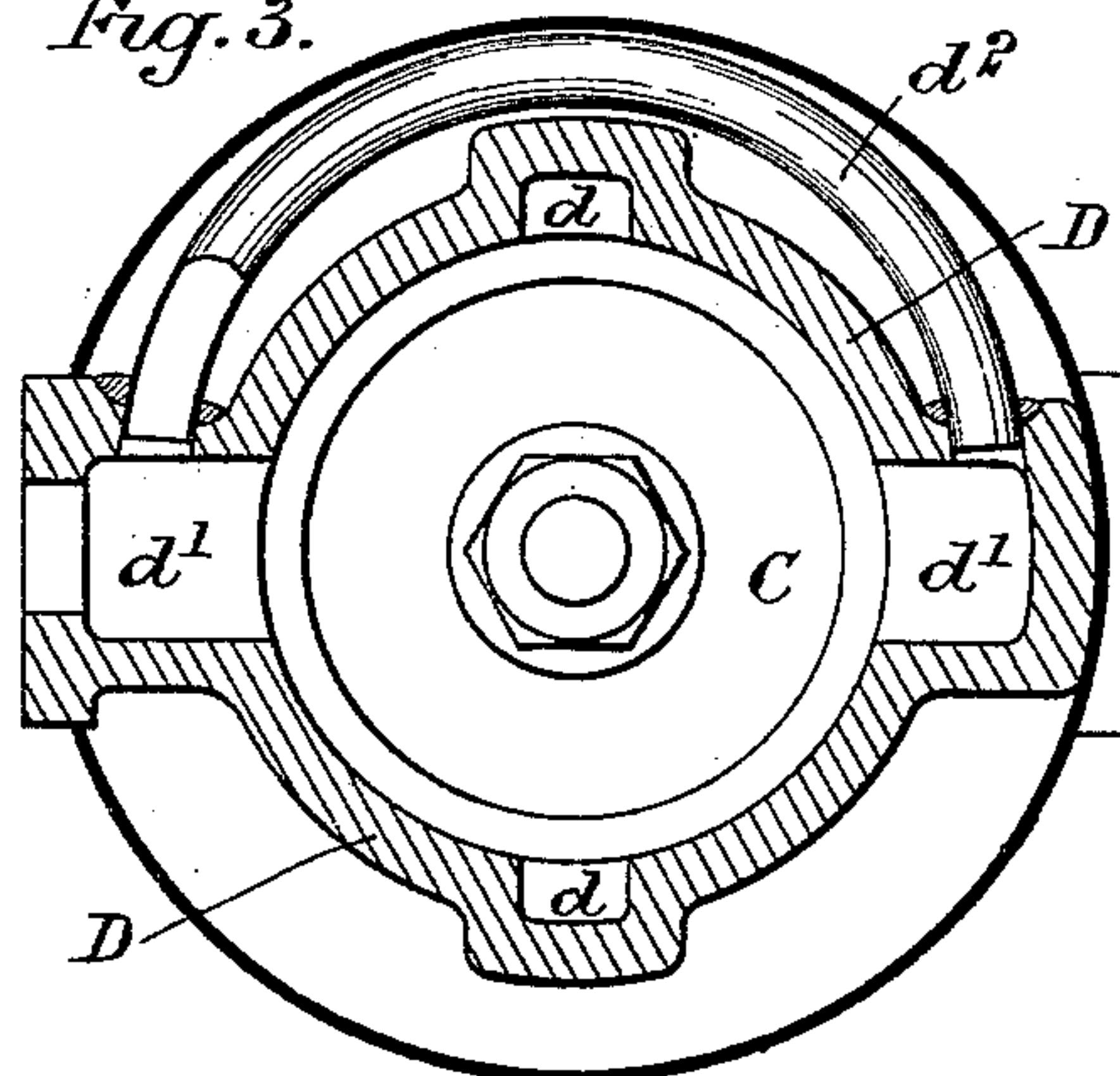


Fig. 3.



WITNESSES:

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DAVID JOY

BY

*Howan and Howan*  
HIS ATTORNEYS.

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Fig. 4.

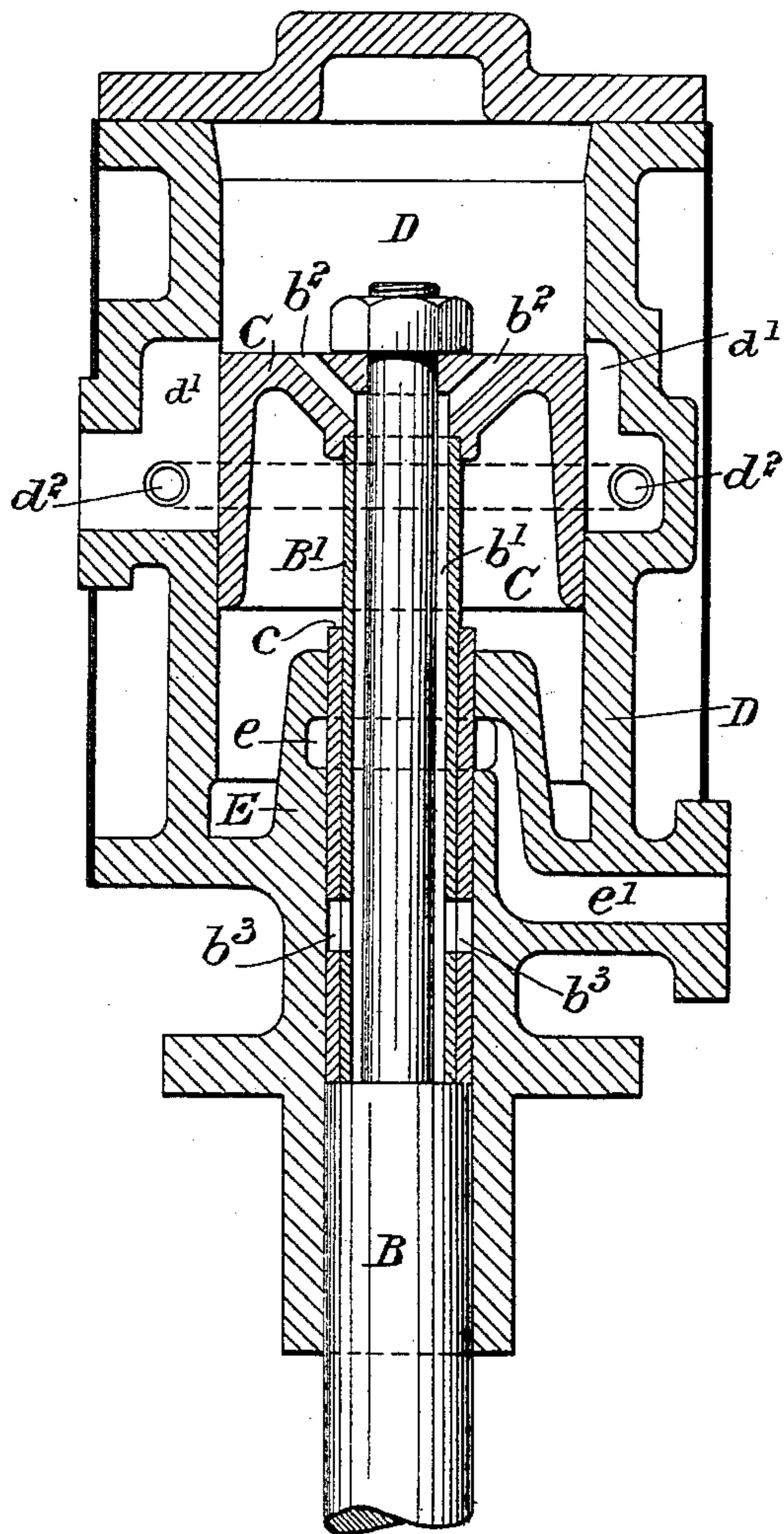
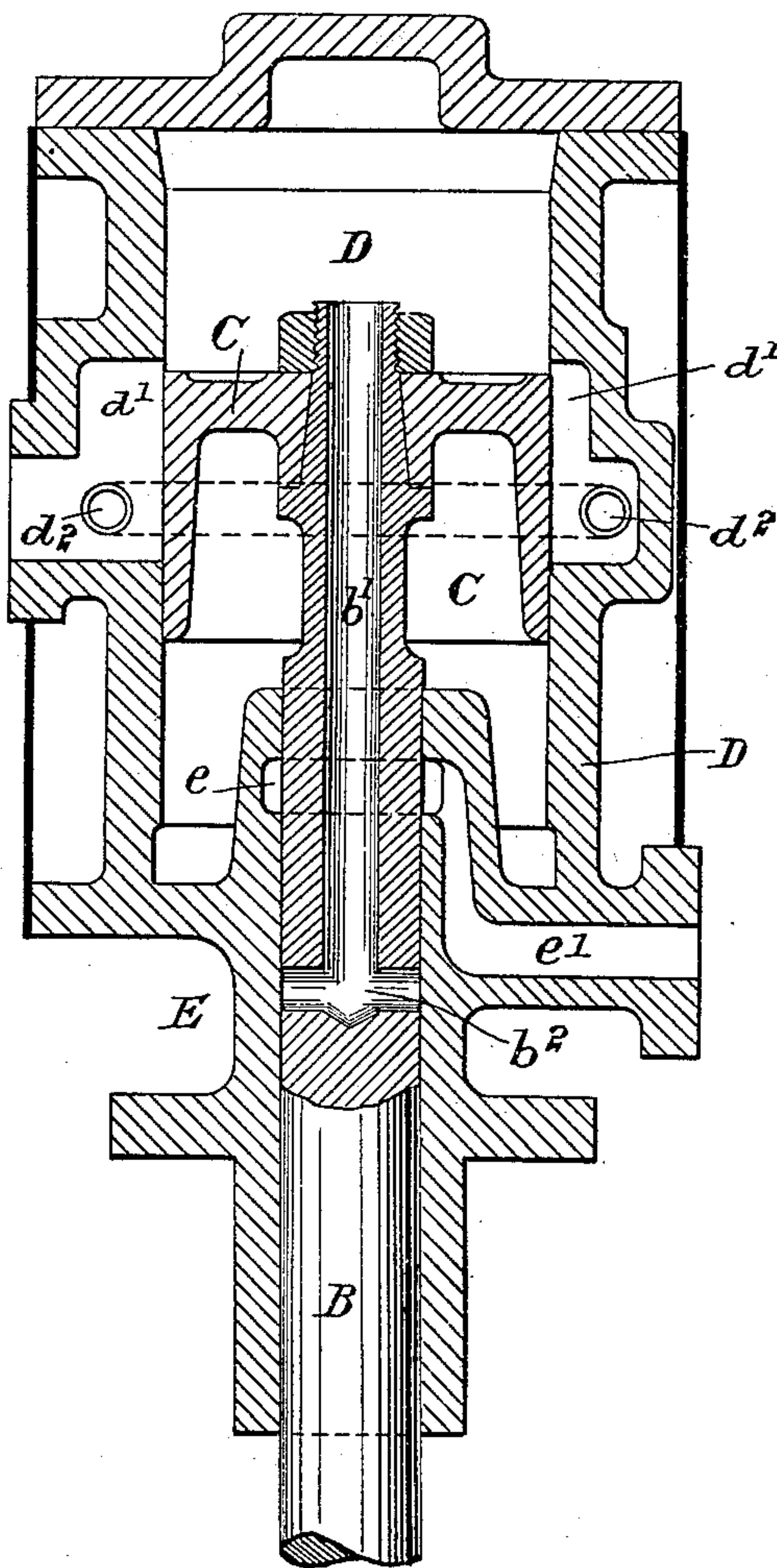


Fig. 5.



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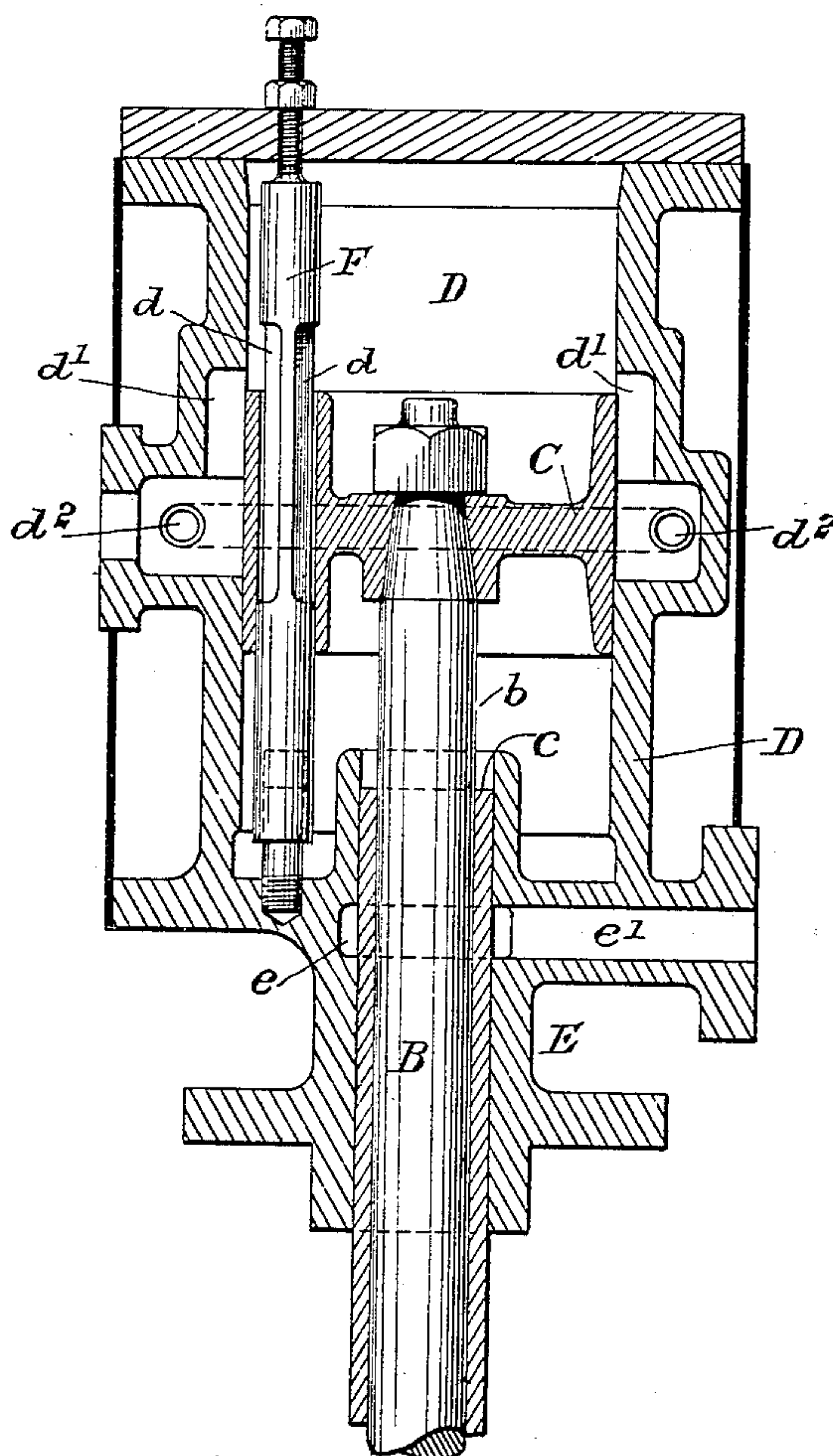
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Fig. 6.



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# UNITED STATES PATENT OFFICE.

DAVID JOY, OF LONDON, ENGLAND.

## VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 620,780, dated March 7, 1899.

Application filed November 21, 1898. Serial No. 697,091. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID JOY, engineer, a subject of the Queen of Great Britain and Ireland, and a resident of 118 Broadhurst Gardens, Hampstead, London, England, have invented certain new and useful Improvements in Valve-Gear for Steam or other Engines Operated by Expansible Fluid, (for which I have applied for a patent in Great Britain, No. 21,574, dated October 13, 1898,) of which the following is a specification.

My invention relates to steam or other engines operated by expansible fluid (which I will refer to as "steam") wherein the valve-gear is provided with what is known as an "assistant" cylinder. Such a gear is described in the specification of British Letters Patent No. 17,168, dated December 13, 1887, the piston in the assistant cylinder of such gear acting as the valve for both admitting and exhausting steam both to and from under and above the piston.

According to my present invention I simplify the arrangement and render it more compact by employing the piston-rod, in conjunction with the gland through which it passes, to form the required ports to pass the steam alternately to the top and bottom of the piston, which can be done by reducing the rod at the right point or by drilling it or by surrounding it with a shell. The steam is exhausted, as in the previous arrangement, by ports in the sides of the cylinder, over which the piston passes, or, having admitted steam to one end of the cylinder, I may pass a part of it before it passes to the exhaust over to the opposite end of the cylinder by ports in the sides of the cylinder or by a bar or post furnished with ports and fixed in the cylinder and over which bar or post the piston slides. This bar may be adjustable.

Figures 1 and 2 are vertical sections, at right angles to each other, of an assistant cylinder constructed according to my invention, and Fig. 3 is a horizontal section on the line 3-3, Fig. 2. Fig. 4 is a vertical section of a modification, and Fig. 5 is a similar section illustrating another modification. Fig. 6 shows a further modification, in which the piston slides along a rod or bar furnished with ports.

Referring to Figs. 1, 2, and 3, A represents a portion of the valve to be operated, the rod

B of which valve carries a piston C, fitted to slide in the assistant cylinder D, which is bolted to the valve-box A'. In the gland or neck E of the cylinder D, through which the rod B passes, is an annular port or passage *e*, into which steam enters by a passage *e'*, which is in connection with the boiler or other source of supply. The rod B for the greater portion of its length accurately fits the bore in the gland or neck E, but is of less diameter than the said bore at the end *b*, which carries the piston C, so that when the piston is in its lowest position in the cylinder D the shoulder C formed at the junction of the reduced part *b* with the larger part of the rod B will be below the annular port or passage *e*, and steam will enter the cylinder beneath the piston and force the said piston to the upper end of the cylinder, thereby reversing the valve A.

The rod B may be made of uniform diameter throughout, and the portion required to be of larger diameter be increased by a casing, as shown in Figs. 1 and 2. In the wall of the cylinder D are ports or passages *d*, which as the piston rises in the cylinder become partially uncovered, so that a portion of the steam admitted to the under side of the piston will pass through the said ports or passages *d* to the upper part of the cylinder above the piston and be compressed by the rising of the said piston. On opposite sides of the cylinder are exhaust-ports *d'*, connected together by a tube *d''*, preferably of copper, the said ports *d'* being of sufficiently large area to admit of a rapid exit for the exhaust-steam from below the piston as the piston descends by the expansive action of the steam admitted above the piston by the ports *d*, as hereinbefore described, and so effect the reverse movement of the valve A. In the modification illustrated by Fig. 4 the reduced portion *b* of the valve-rod B is surrounded by a sleeve or casing B', an annular space *b'* being provided between the said sleeve B' and the piston-rod. The external diameter of the sleeve B' corresponds with the diameter of the valve-rod and forms a continuation thereof, so as to slide in the gland or neck E of the cylinder D. The end of the sleeve near the piston C is reduced in diameter, so as to admit steam to beneath the piston by the passage *e'* and annular port or



passage  $e$  when the said piston is at the lower end of the cylinder. The annular space  $b'$  communicates with the cylinder D above the piston C by passages  $b^2$  in the piston, lateral passages  $b^3$  being provided in the sleeve  $B'$ , which passages, when the piston is at the upper end of the cylinder, coincide with the annular port or passage  $e$  in the gland or neck E of the cylinder, so that steam entering the said annular port  $e$  by the passage  $e'$  will pass through the lateral passages  $b^3$  into the annular space  $b'$  and thence through the passages  $b^2$  in the piston to the cylinder above the piston and effect the downstroke of the said piston and so reverse the main valve of the engine, as before described. In the modified arrangement illustrated by Fig. 5 the rod B is provided with an axial passage  $b'$  and transverse passages  $b^2$ , communicating with the inner end of the said axial passage. When the piston C is at the upper end of the cylinder D, the passages  $b^2$  coincide with the annular port  $e$  in the neck or gland E, so that steam entering the passage  $e'$  will pass through the passage  $b^2$  and axial passage  $b'$  into the cylinder D above the piston C and force the said piston to the opposite end of the cylinder and thereby reverse the valve connected to the rod B.

Instead of forming ports in the cylinder for the passage of steam from one side of the piston to the other side thereof the said ports may be provided in a rod or bar F, as shown in Fig. 6, adjustably fixed in the cylinder. The piston C slides on the said rod, which passes through an opening of corresponding size formed in the said piston. A portion of the rod or bar F is chamfered or cut away, as shown at  $d$ , to form passages or ports, through which part of the steam admitted by the passage  $e'$  to beneath the piston can pass to the top of the piston and be compressed by the rising of the said piston, the said steam then acting by expansion to effect the return stroke of the piston, as in the previously-described arrangement, the exhaust-steam escaping by the port  $d'$ .

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination with the valve of an engine operated by expansible fluid, of an assistant cylinder, a piston in said cylinder, a piston-rod passing through a gland on said cylinder and connecting said piston with the valve, a port or passage in the gland connected to a source of fluid-supply, the rod and port or passage of the gland being so formed and arranged as to control the admission of fluid to the cylinder, said cylinder having a suitable exhaust port or passage, whereby the piston may be reciprocated, substantially as described.

2. The combination with the valve of an engine, operated by expansible fluid, of an assistant cylinder, a piston operating therein

and having a rod passing through the gland on said cylinder and connected to the valve, a port or passage in said gland connected to a source of fluid-supply and controlled by the piston-rod to admit the fluid to one side of the piston, said cylinder having ports or passages in its wall adapted to transfer the fluid from one side of the piston to the other to effect the return movement of the piston by the expansive action of the fluid, substantially as described.

3. The combination with the valve of an engine, operated by expansible fluid, of a cylinder and a piston reciprocating therein, a rod connecting said piston and valve, means for admitting the fluid to one side of the piston, said cylinder having exhaust ports or passages and recesses or passages in the wall thereof controlled by the piston and adapted to transfer the fluid from one side of the piston to the other, whereby the return movement of said piston is effected by the expansive action of the fluid, before it is exhausted from the cylinder, substantially as described.

4. The combination with the valve-gear of engines operated by expansible fluid, of a cylinder and piston; a rod connecting the said piston to the valve to be operated; the said rod having a part of less diameter than the other part; a gland or neck on the cylinder in which the larger portion of the rod slides; an annular recess or port in the gland, in communication with the steam-supply, and situated so that when the piston is at one end of the cylinder the reduced portion of the rod will be opposite the said port and allow steam to enter the cylinder to force the piston to the opposite end of said cylinder; recesses or passages  $d$  in the inner surface of the cylinder through which steam admitted to one side of the piston can pass to the opposite side thereof to effect the return stroke of the piston, substantially as hereinbefore described.

5. The combination with the valve-gear of engines operated by expansible fluid, of a cylinder and piston; a rod connecting the said piston to the valve to be operated; means for admitting steam to the cylinder at one side of the piston, to force the piston in one direction in the cylinder; recesses in the interior surface of the cylinder through which steam can pass from one side of the piston to the opposite side of the said piston to effect by the expansion of the steam the return stroke of the said piston; and ports or passages in the wall of the cylinder for the exit of the exhaust-steam substantially as hereinbefore described.

6. The combination with the valve-gear of engines operated by expansible fluid, of a cylinder and piston; means for admitting steam to the cylinder to force the piston in one direction; a rod connecting the piston to the valve to be operated; a neck or gland on the cylinder in which the piston-rod slides; an annular recess or port in the said neck or gland, in connection with the steam-supply;



a portion of reduced diameter on the piston-rod; a sleeve or casing surrounding the reduced portion of the piston-rod; an annular space between the sleeve and the reduced portion of the piston-rod; transverse openings in the sleeve, communicating with the said annular space, and with the annular recess or port in the neck or gland on the cylinder when the piston is at one end of the cylinder; passages in the piston through which steam admitted to annular space can pass into the cylinder to effect the return stroke of piston; and ports or passages in the wall of the cylinder for the escape of exhaust-steam from the cylinder substantially as hereinbefore described.

7. The combination with the valve-gear of engines operated by expansible fluid, of a cylinder and piston; means for admitting steam to the cylinder to force the piston in one direction a rod connecting the piston to the valve to be operated; a neck or gland on the cylinder in which the piston-rod slides; an annular recess or port in the gland communicating with the steam-supply; an axial or longitudinal passage in the piston-rod, a transverse passage in the piston-rod communicating with the axial passage and so situated that when the piston is at one end of the cylinder the said transverse passage will co-

incide with the annular passage or port in the neck or gland and admit steam to the opposite side of the piston to effect its return stroke; ports or passages in the wall of the cylinder on opposite sides thereof, for the escape of exhaust-steam and a tube or passage connecting the said ports or passages substantially as hereinbefore described.

8. The combination with the valve-gear of engines operated by expansive fluid, of a cylinder and piston, a rod connecting the piston to the valve to be operated; a fixed rod or bar in the cylinder on which the piston slides, a hole in the piston corresponding to the diameter of the rod, through which hole the rod or bar passes, chamfers or recesses at one portion of the rod or bar to form ports for the passage of steam from one side of the piston to the other side thereof; means for admitting steam to the cylinder, and a port for the escape of exhaust-steam from the cylinder substantially as hereinbefore described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

DAVID JOY.

Witnesses:

EDWARD GEORGE DAVIES,  
WILLIAM FREDERICK UPTON.