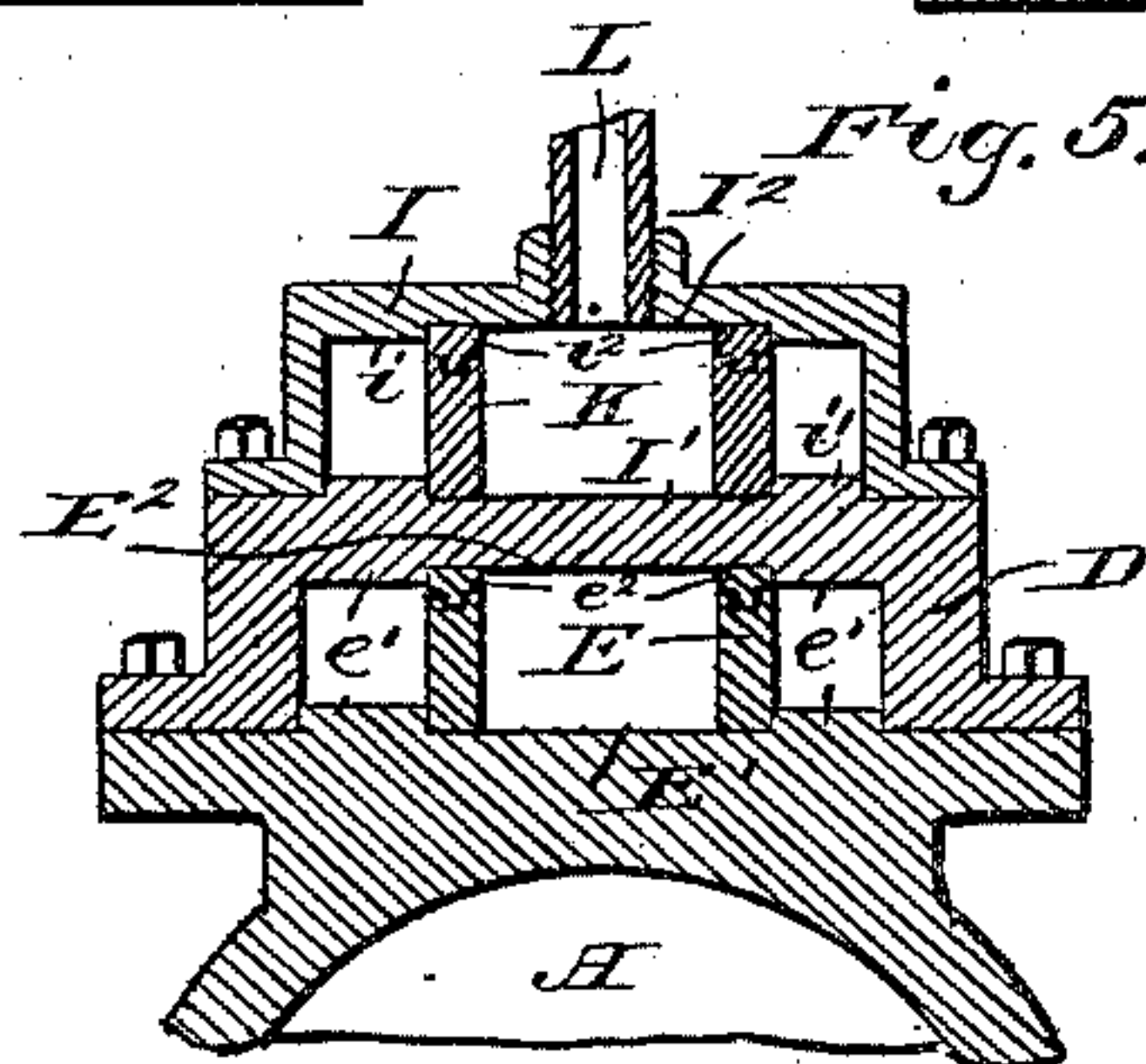
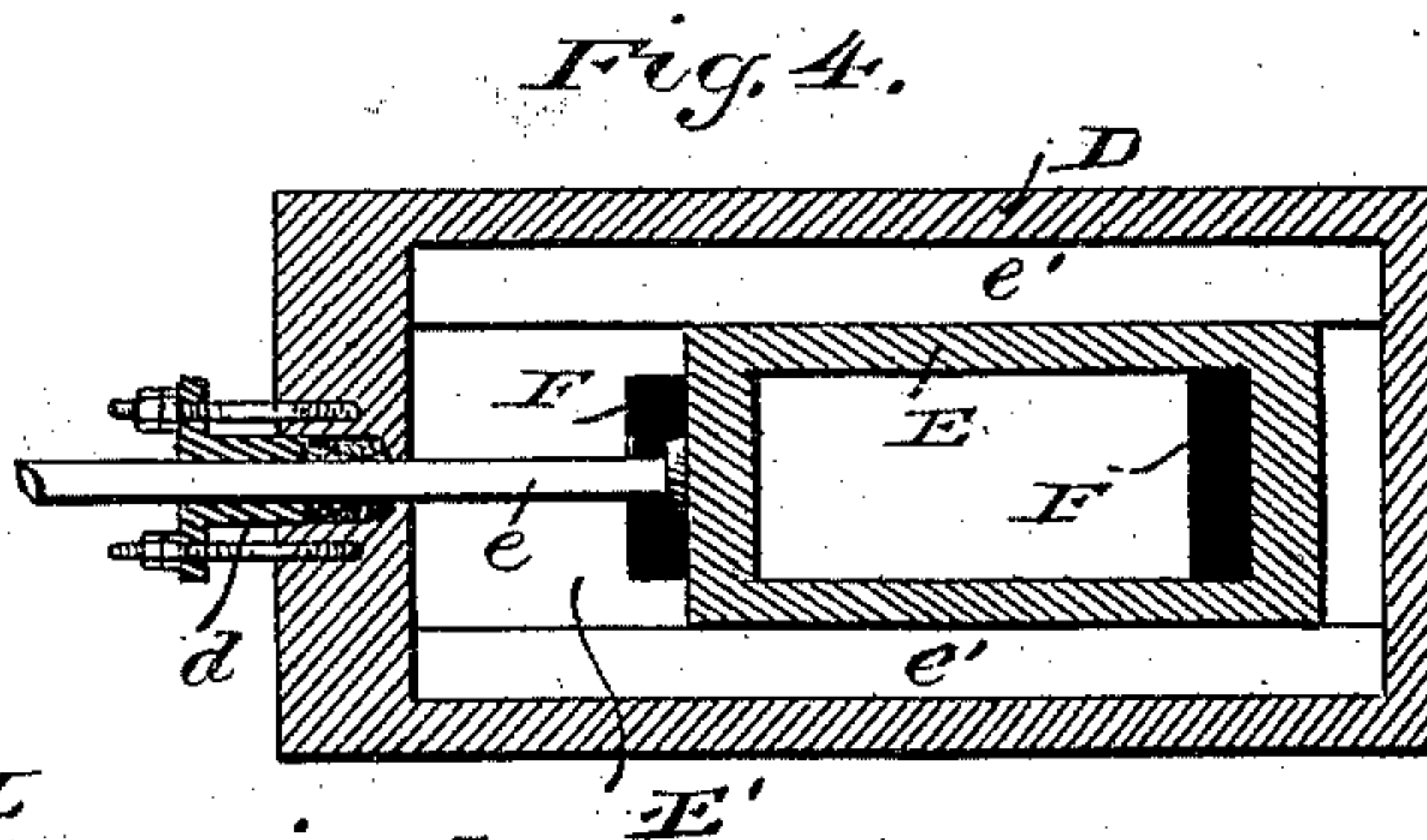
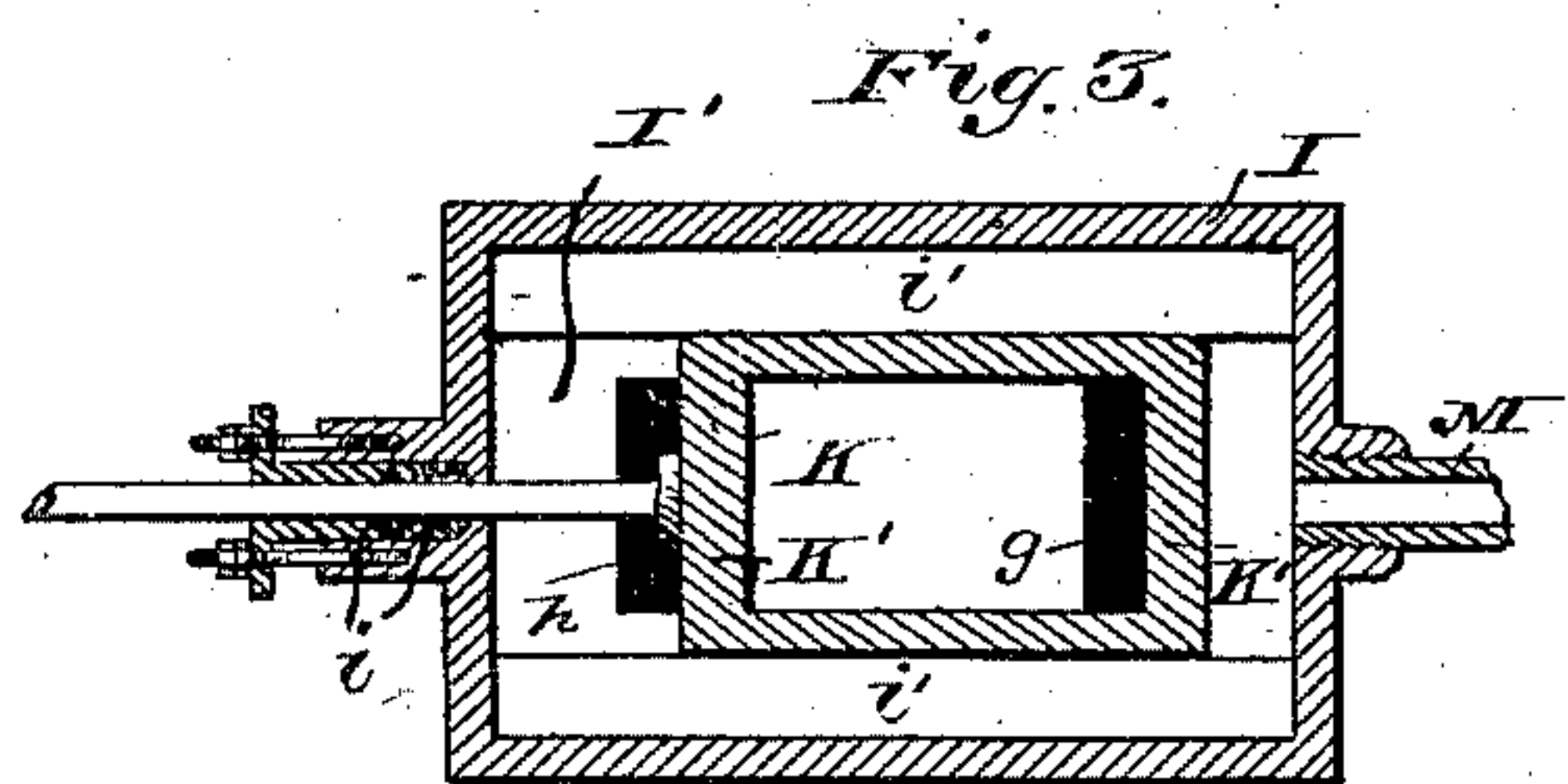
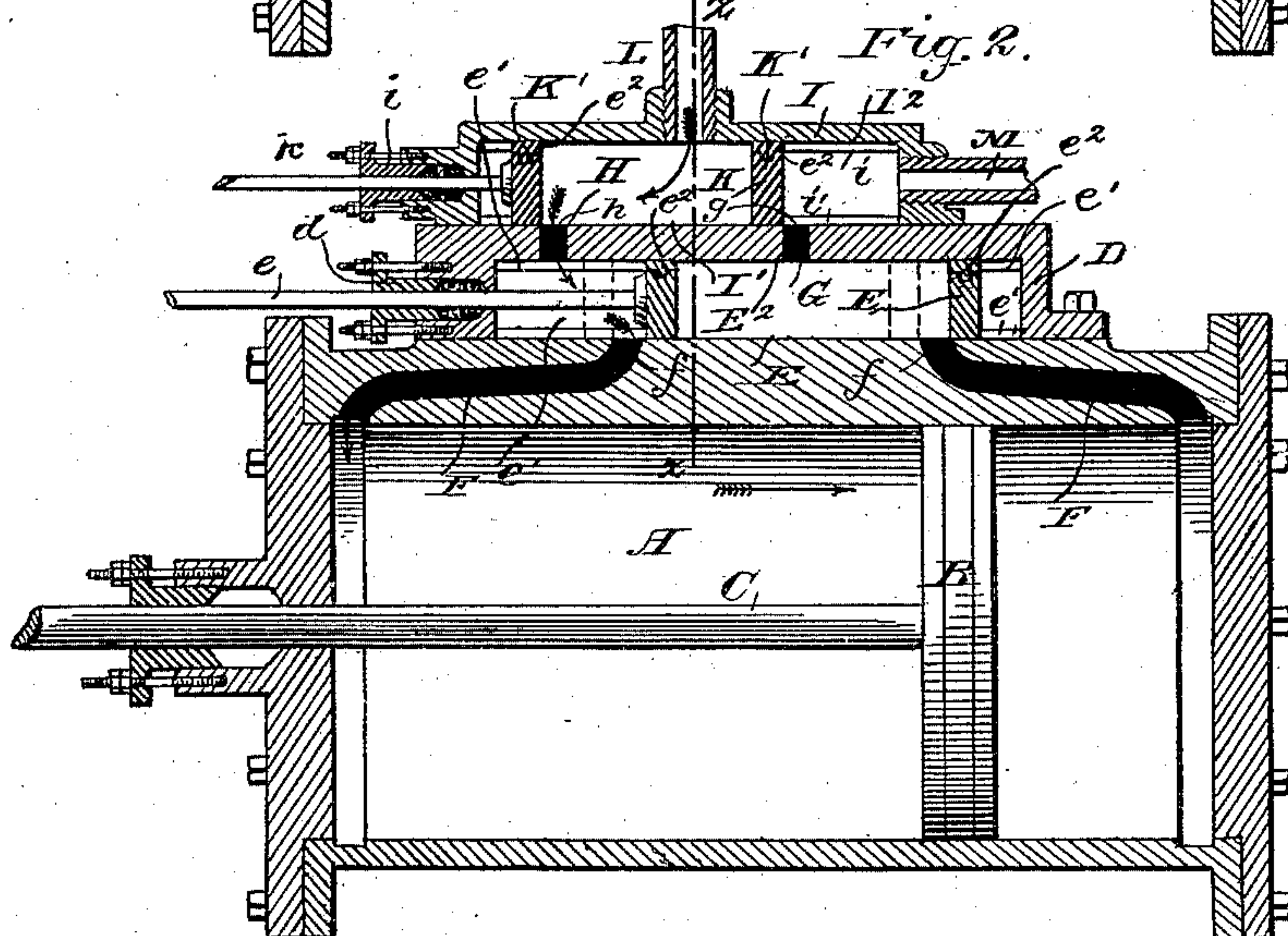
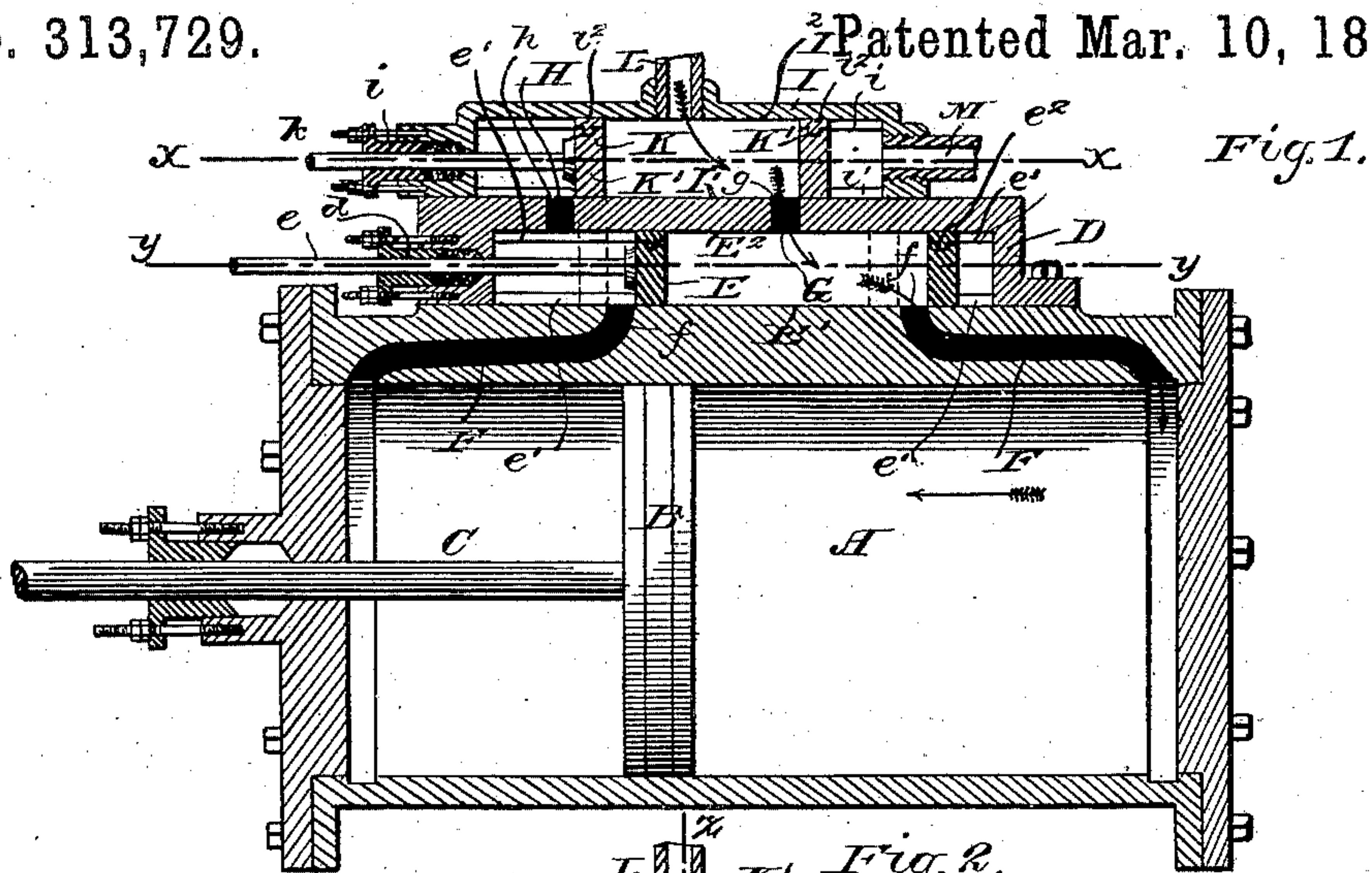


(No Model.)

D. D. HARDY.
STEAM ENGINE VALVE.

No. 313,729.

²
Patented Mar. 10, 1885.
72.



Witnesses;
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UNITED STATES PATENT OFFICE.

DEXTER D. HARDY, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO ROBERT H. COWDREY, OF SAME PLACE, AND MARY J. PERRY, OF DOWNER'S GROVE, ILLINOIS.

STEAM-ENGINE VALVE.

SPECIFICATION forming part of Letters Patent No. 313,729, dated March 10, 1885.

Application filed May 10, 1884. (No model.)

To all whom it may concern:

Be it known that I, DEXTER D. HARDY, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Engine Valves; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an improved construction in steam-valves for engines. It embraces an improved construction in balanced slide-valves for controlling the cylinder-ports of a steam-engine, and also an improvement in reversing-valves adapted for use either with the balanced valve mentioned or with other forms of steam-valves; and it consists in the matters hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figures 1 and 2 are central longitudinal sectional views of an engine-cylinder illustrating my invention. Fig. 3 is a horizontal section taken upon line *xx* of Fig. 1. Fig. 4 is a horizontal section taken upon line *yy* of Fig. 1. Fig. 5 is a vertical section taken upon line *zz* of Fig. 2.

As shown in the accompanying drawings, A is an engine-cylinder, having a piston, B, and piston-rod C, of ordinary construction.

D is a steam-chest, which is provided with opposite parallel plane surfaces forming valve-seats *D'* and *D²*, the valve-seat *D'*, as herein shown, being adjacent to the cylinder, and provided with ports *f f*, communicating with the ends of the cylinder by means of passages *F F*, in the usual manner.

Within the steam-chest D is a centrally-open or hollow slide-valve, E, which is operated by means of a valve-rod, *e*, passing through an ordinary stuffing-box, *d*, in the wall of the steam-chest D. The said valve is, as herein shown and preferably constructed, rectangular in form, and narrower than the space between the side walls of the steam-chest, so as to permit the passage of steam around it from one end to the other of the said steam-chest, and is constructed to bear at its

edges upon the opposite valve-seats, *D'* and *D²*, of the steam-chest.

G and H are steam inlet and exhaust passages, communicating with the steam-chest in its portion inside of and exterior to the slide-valve. The ports *f f* are arranged at the same distance apart as the transverse end pieces, *E'*, of the valve E; and the said valve operates, in connection with said ports, to admit steam alternately to the opposite ends of the cylinder in a well-known manner. The bearing-surfaces upon the opposite side of the valve E are preferably made of the same width, so that the area of such surface in contact with each of the valve-seats *D'* and *D²* is the same, and the steam-pressure upon the valve will thereby be perfectly balanced. The valve E is preferably provided at one of its edges with a separate part or strip, *e'*, which is held outwardly in contact with the valve-seat by means of metal or other springs, so as to form a packing, in a well-known manner. The same effect will obviously be produced by permitting the entrance of steam between the parts of the valve, so as to press said parts against the opposite valve-seats, thus forming what is known as a "steam-packing." The valve E is, as herein shown, held between guides *d' d'*, formed upon the opposite surfaces of the steam-chest adjacent to the valve-seats. The said valve may, however, be otherwise held and guided, as may be found convenient or practicable, and the particular form of guides shown are not essential to the operation of the valve.

I is a valve-chamber, with which the passages G and H, leading from the steam-chest, communicate, and which may be located upon the said steam-chest, as herein shown, or elsewhere, or at a distance therefrom, as found desirable. The said valve-chamber I is connected with suitable steam-inlet pipes, L, leading from the steam-generator, and is provided with an exhaust-pipe, M, for the exit of steam therefrom. The passages G and H, which connect the steam-chest with the valve-chamber I, terminate within the latter chamber in ports *g h*, and within said chamber I is located a slide-valve, K, which is generally similar in

construction to the valve E, before described, and operates in contact with opposite parallel valve-seats, I' I², in the said chamber. The ports *g h* are, as herein shown, formed in the valve-seat I', and the valve K operates, in connection with the said ports, to bring either the inlet L or exhaust-passage M into communication with the passages G or H, as hereinafter more particularly described. The valve K is, as shown, of rectangular form, and provided with four walls fitted at their edges to the opposite plane faces of the chamber, spaces being left between the sides of the valve and the side walls of the chamber, as clearly shown in Fig. 5, to permit the passage of steam from one end of the chamber to the other around the valve. The said valve is, as herein shown, operated by means of a valve stem or rod, *k*, passing through a suitable stuffing-box, *i*, in the wall of the chamber I, and its transverse end portions, K', are located at the same distance apart as the ports *g* and *h* of the passages G and H, so that when the valve is moved a distance equal to the width of one of the ports, plus the thickness of one of the parts K', the ports will be brought inside or outside of the valve in a well-known manner. The guides *i' i'* are, as herein shown, formed upon the opposite parallel faces of the valve-chamber I, between which guides the valve K is arranged to slide; but any other well-known means of supporting the said valve may obviously be used in connection with the form of valve illustrated. The valve K is preferably provided with a separate piece or packing-strip, *k'*, similar to that before described in connection with the valve E, and the said valve, having equal opposite bearing-surfaces, as before set forth, in connection with said valve E, is also perfectly balanced with reference to steam-pressure tending to force the valve against its seat in either direction. The inlet-pipe L enters the valve-chamber I in its central portion and communicates with the space of the chamber within the hollow valve K, and the exhaust-pipe M communicates with the portion of the chamber exterior to the valve, the said inlet and exhaust pipes being so arranged that they are unaffected by the movement of the valve, which operates upon the ports *g* and *h* only.

The effect of changing the position of the valve K with reference to the ports is obviously to reverse the course of the steam through the passages G and H, and thereby change the direction of motion of the engine, as will be rendered clear by an inspection of Figs. 1 and 2 of the accompanying drawings, in which the valve K is shown in the two positions taken by it at the opposite limits of its throw.

In Fig. 1 the reversing-valve K, above referred to, is shown in position, with the passage G in communication with the space within the interior of the valve K, and the passage H in communication with the space of the valve-chest exterior to the said valve, so that passage is afforded for steam from the inlet-

pipe L, which opens into the interior space of the valve through the said passage G to the steam-chest, and also from the passage H to the exhaust-passage M. In this case the passage G obviously forms the steam-inlet to, and the passage H the exhaust-passage from, the steam-chest.

In Fig. 2 the valve K is shown at the opposite end of its throw from that shown in Fig. 1, the inlet-passage L being in this case in communication with the passage H, and the exhaust-pipe M in communication with the passage G, so that the passage G has become the exhaust-passage of the steam-chest, and passage H the inlet-passage thereto. The slide-valve E is shown in the same position in both figures mentioned, and the course of the steam by arrows.

It is obviously immaterial to the operation of the valves E and K as to the points at which the inlet and exhaust passages enter the steam-chest and valve-chamber, it only being necessary in either case that one of the passages communicate with the interior space of the valve, and the other with the space of the valve chest or chamber exterior thereto. The said passages may, for instance, enter the valve chest or chamber at the side thereof opposite to that at which they are shown as entering it, in the same manner that the steam inlet and exhaust passages used in connection with an ordinary D-valve usually enter the valve-chamber.

By the construction above described in the reversing-valve K it is obvious that means are provided for reversing the direction of motion of the engine without the use of the link mechanism or other reversing-gear therefor used, and that said valve is perfectly balanced, and may therefore be operated by the exertion of very little force upon the valve-rod.

The reversing-valve described is especially valuable as applied to locomotive-engines, for the reason that by its use the link reversing-gear heretofore used in such engines, which is objectionable on account of its weight and cost and the force required to operate it, may be dispensed with.

It is obviously possible to use any kind of steam-valve for controlling the cylinder-ports in connection with the reversing-valve described, instead of the balanced slide-valve herein shown; and it is also obvious that any suitable form of slide-valve may be used as a reversing-valve in place of the balanced valve shown—as, for instance, an ordinary D-valve. I do not therefore limit myself to a construction in which the reversing-valve is used in combination with the balanced slide-valve shown, except in the claims, in which such combination is expressed; nor do I limit myself to the exact features of construction in the reversing-valve or the steam-valve herein illustrated, except in the claims, in which such features of construction are set forth.

I claim as my invention—

1. The combination, with a steam chest and

valve of an engine, of an auxiliary valve-chamber having opposite parallel valve-seats, and ports communicating with the steam-chest, a centrally-open slide-valve in said
5 chamber, constructed to operate in connection with the opposite valve-seats, and steam inlet and exhaust pipes communicating with the portion of the valve-chamber within the slide-valve, and with the space of the valve-cham-
10 ber exterior to said valve, substantially as and for the purpose set forth.

2. The combination, with the cylinder of a steam-engine, of a steam-chest having opposite parallel valve-seats, a centrally-open slide-
15 valve operating in contact with the opposite valve-seats of said steam-chest, suitable steam-passages connecting the steam-chest with the cylinders, an auxiliary valve-chamber having opposite parallel valve-seats, and ports com-
20 municating with the portion of the steam-chest within the slide-valve, and with the space of the steam-chest exterior to the valve, a centrally-open slide-valve within said valve-chamber, constructed to operate in contact

with the opposite valve-seats of the said valve- 25
chamber, and steam inlet and exhaust pipes communicating with the space of the valve-chamber inclosed by the slide-valve, and with the space of the chamber exterior to said
slide-valve, substantially as and for the pur- 30
pose set forth.

3. The combination, with the cylinder of a steam-engine, of a steam-chest having oppo-
site parallel valve-seats, a centrally-open
slide-valve of less width than the space be- 35
tween the walls of the steam-chest, constructed to work in contact with the opposite valve-seats, and guides *d'* within the steam-chest, for retaining the said valve in position, substan-
tially as described. 40

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

DEXTER D. HARDY.

Witnesses:

M. E. DAYTON,
JESSE COX, Jr.