

(No Model.)

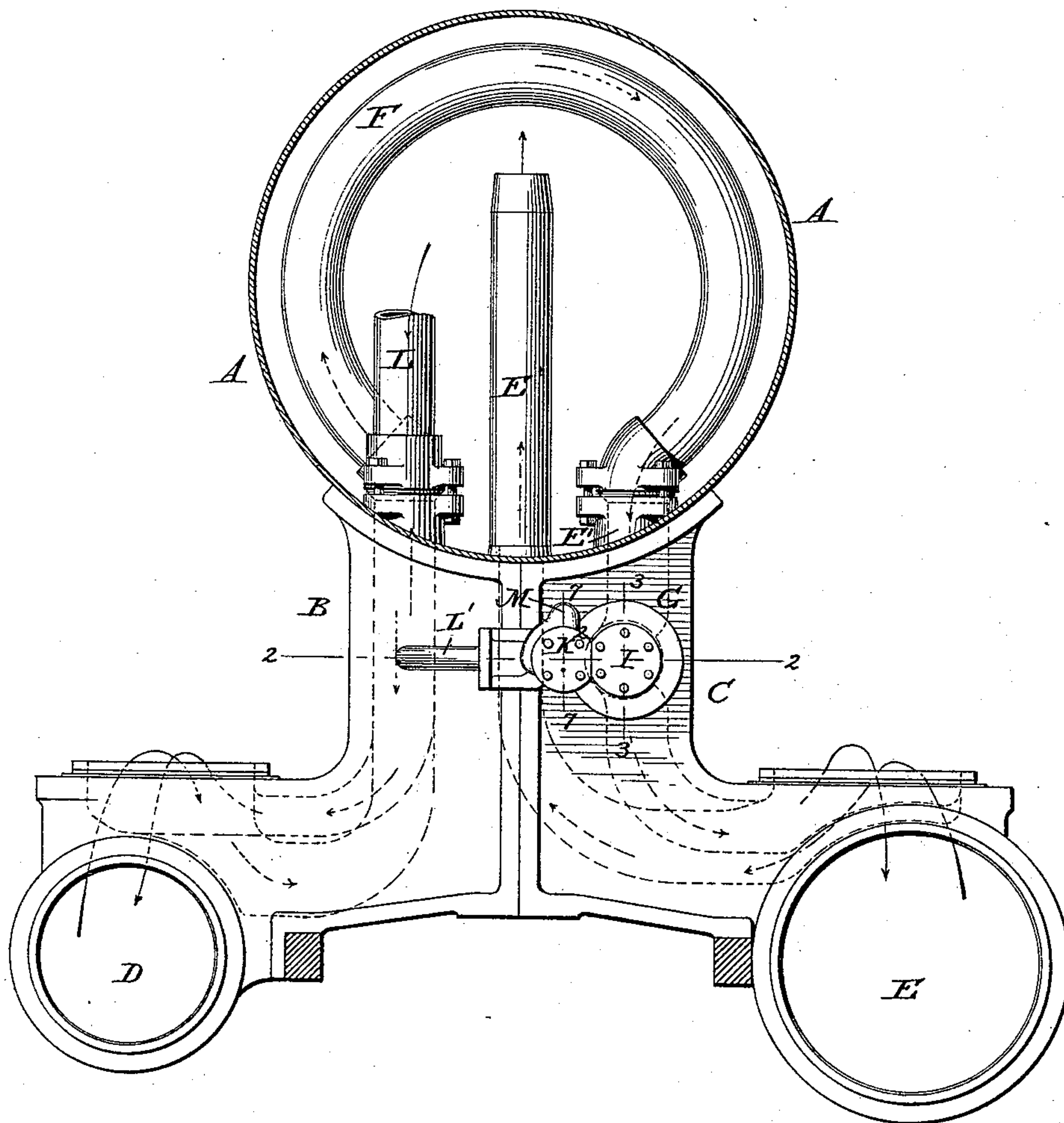
3 Sheets—Sheet 1.

A. J. PITKIN.
COMPOUND ENGINE.

No. 450,374.

Patented Apr. 14, 1891.

Fig. 1



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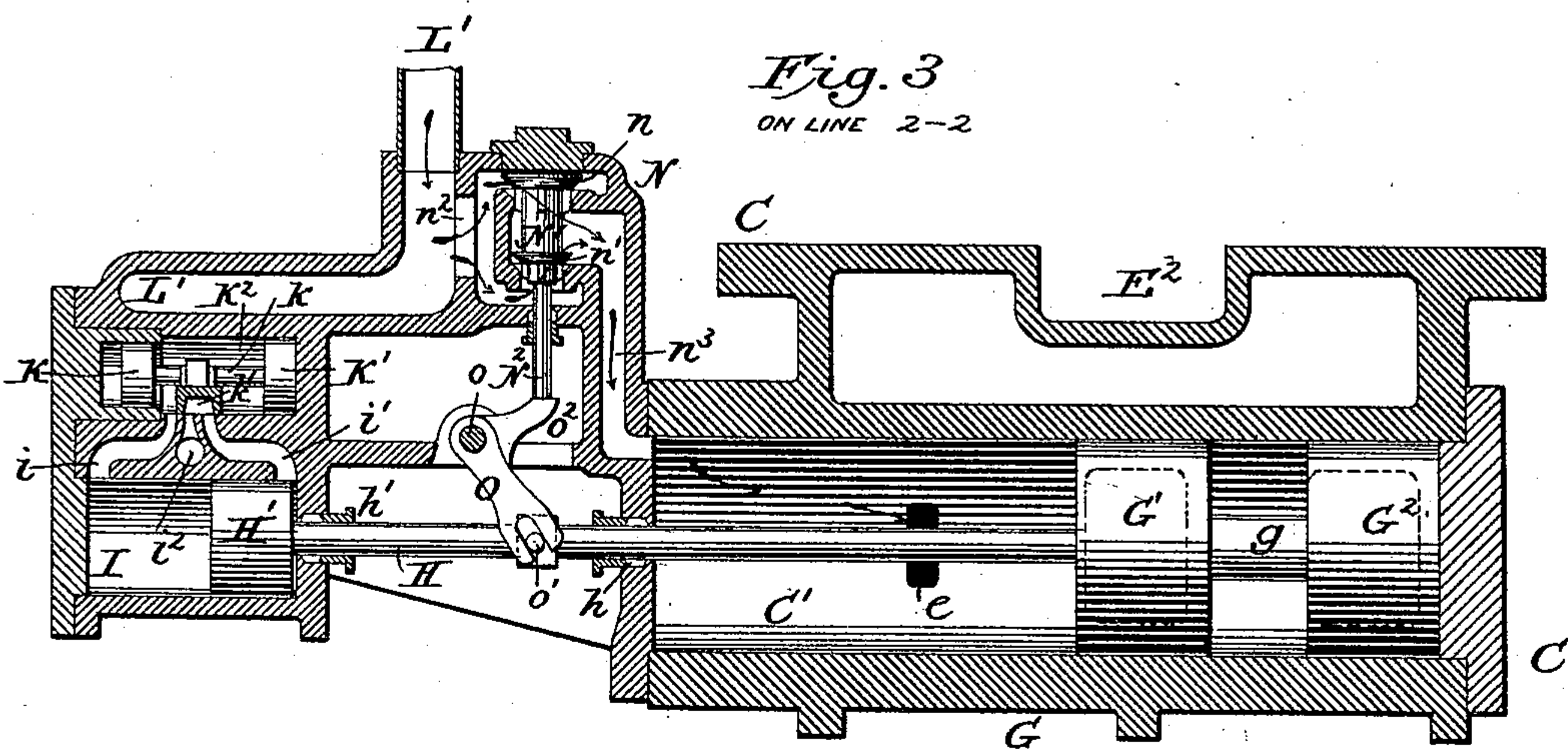
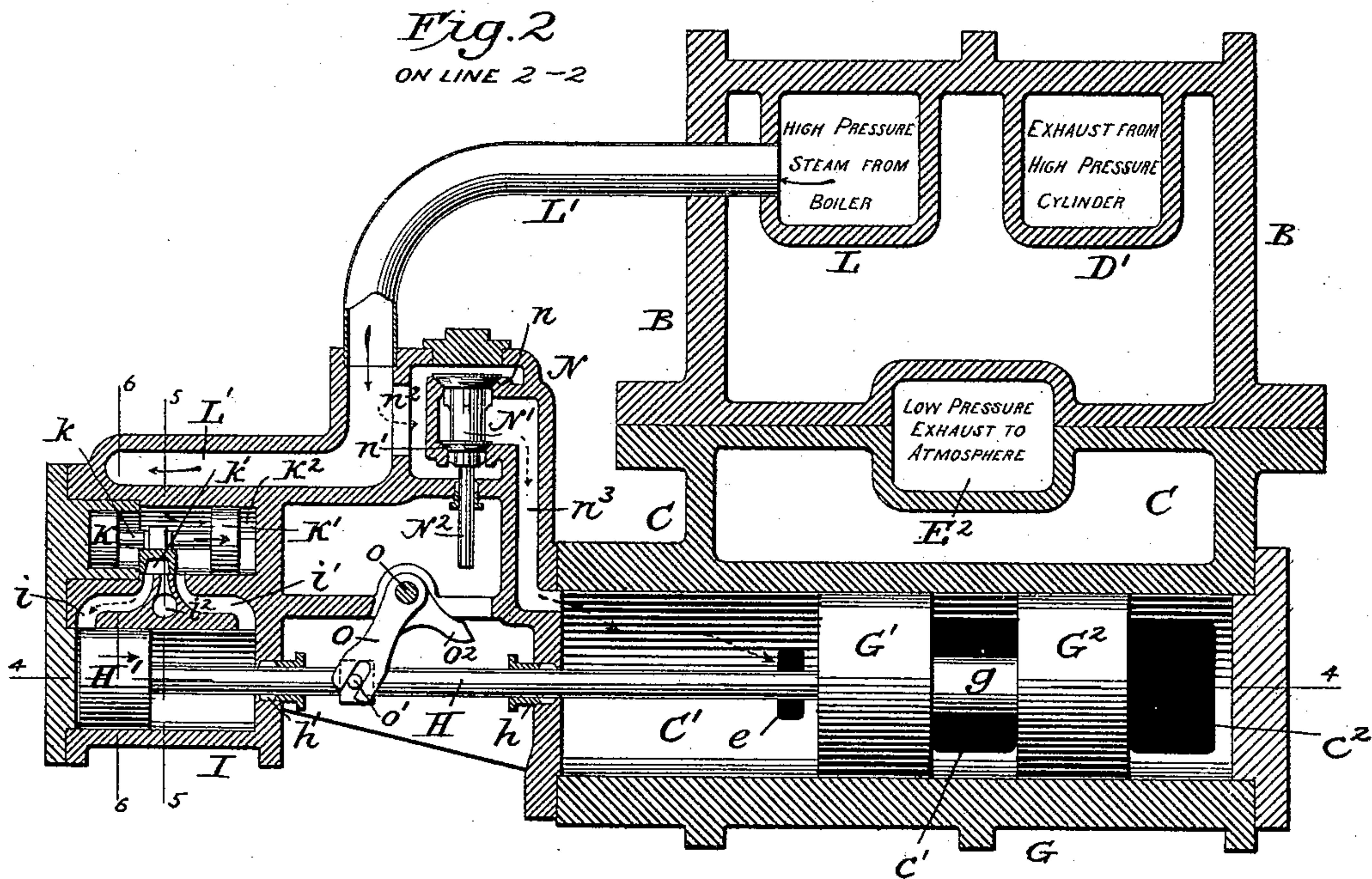
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ALBERT J. PITKIN
by his attorneys

Baldwin, Davidson & Wright

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3 Sheets—Sheet 3.

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Fig. 4.

ON LINE 4-4

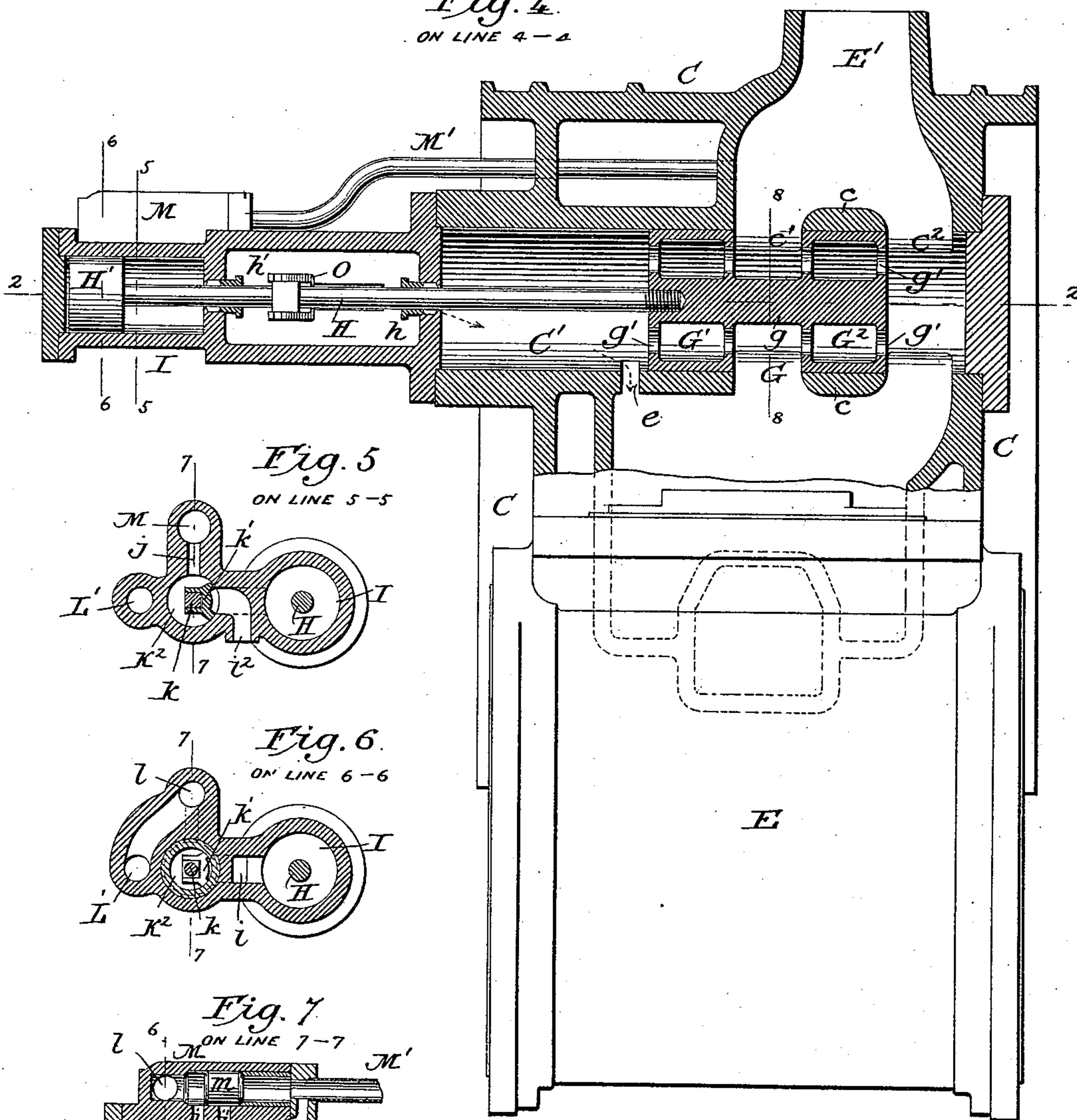


Fig. 5

ON LINE 5-5

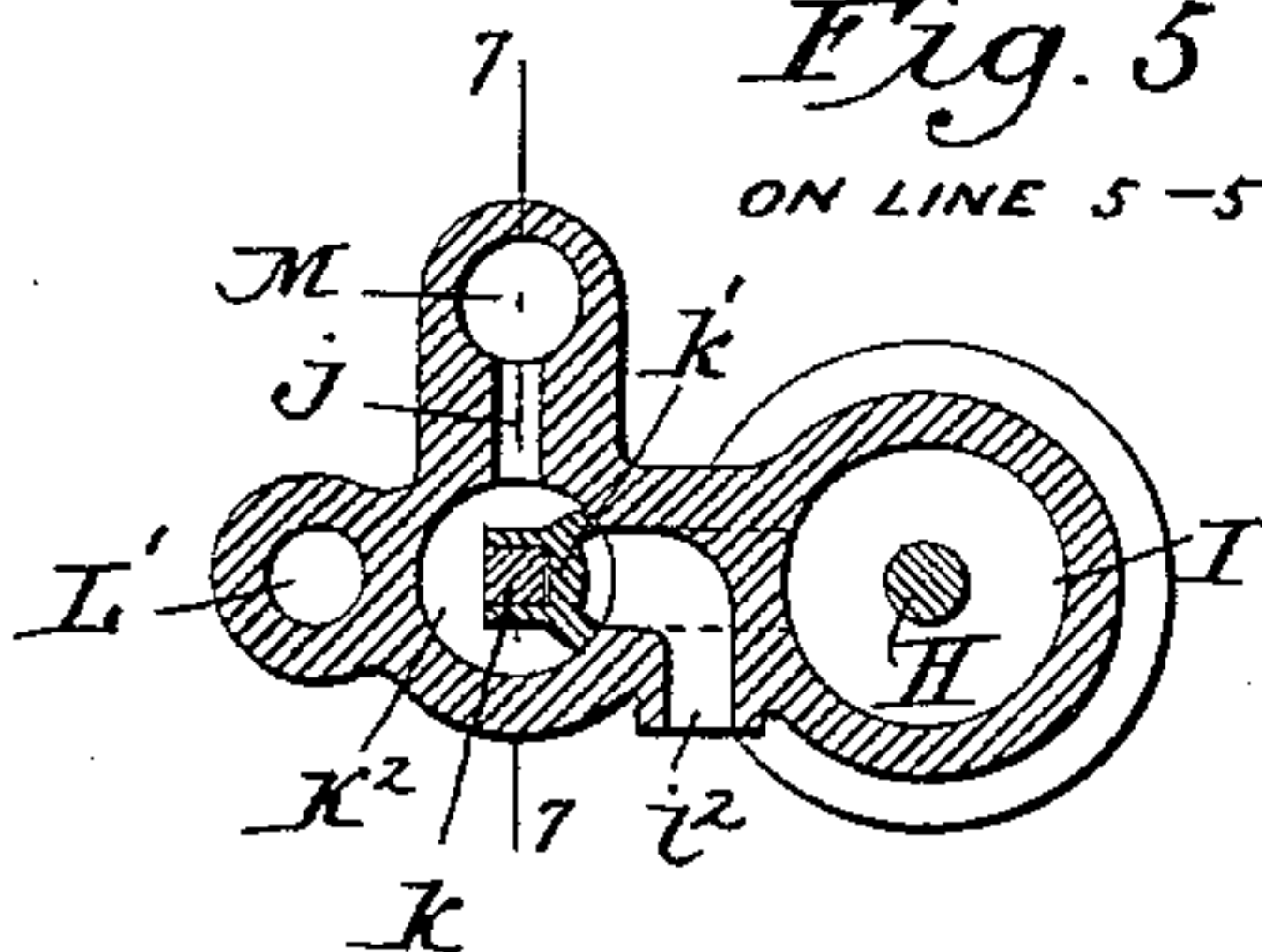


Fig. 6

ON LINE 6-6

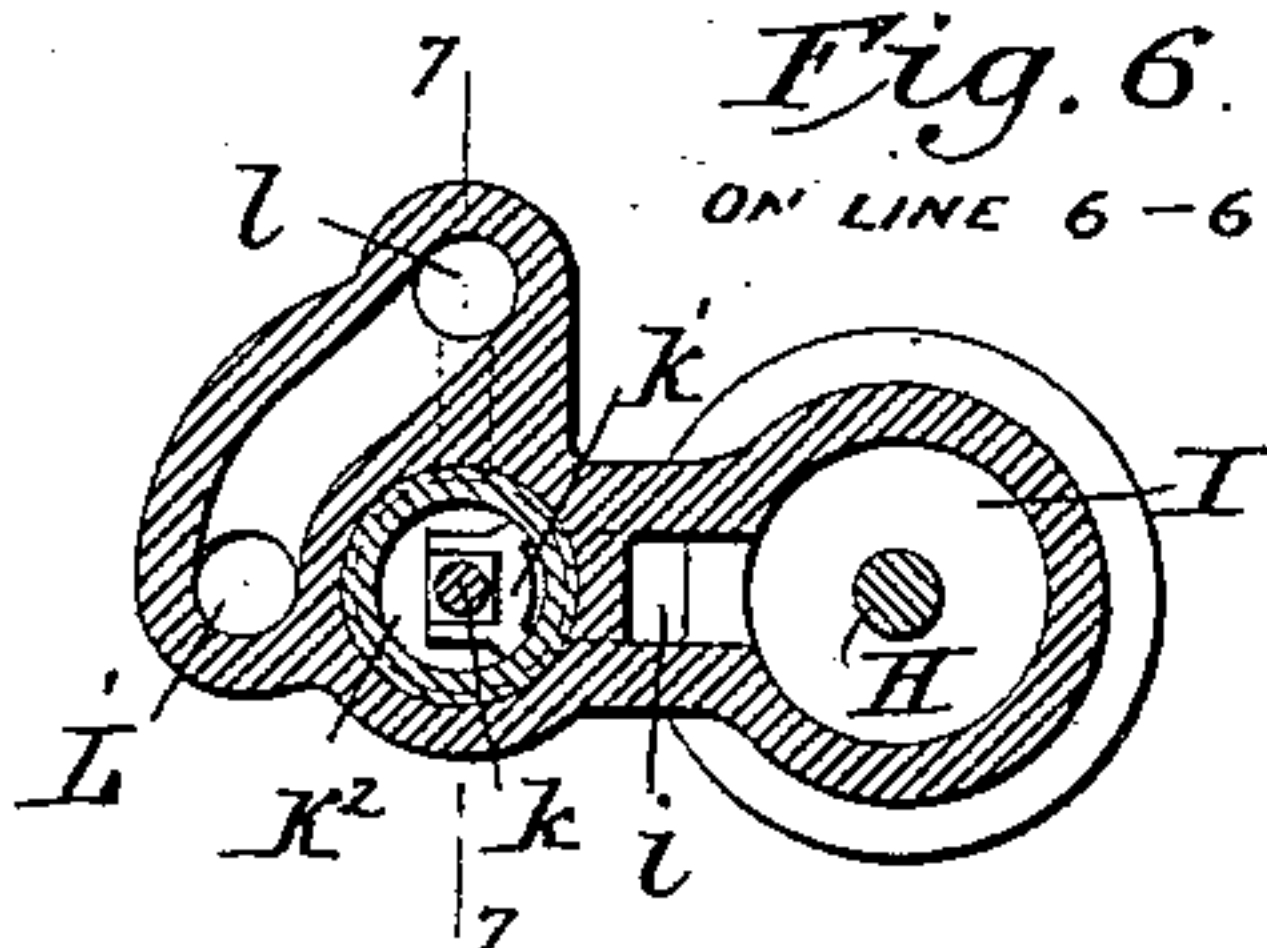


Fig. 7.

ON LINE 7-7

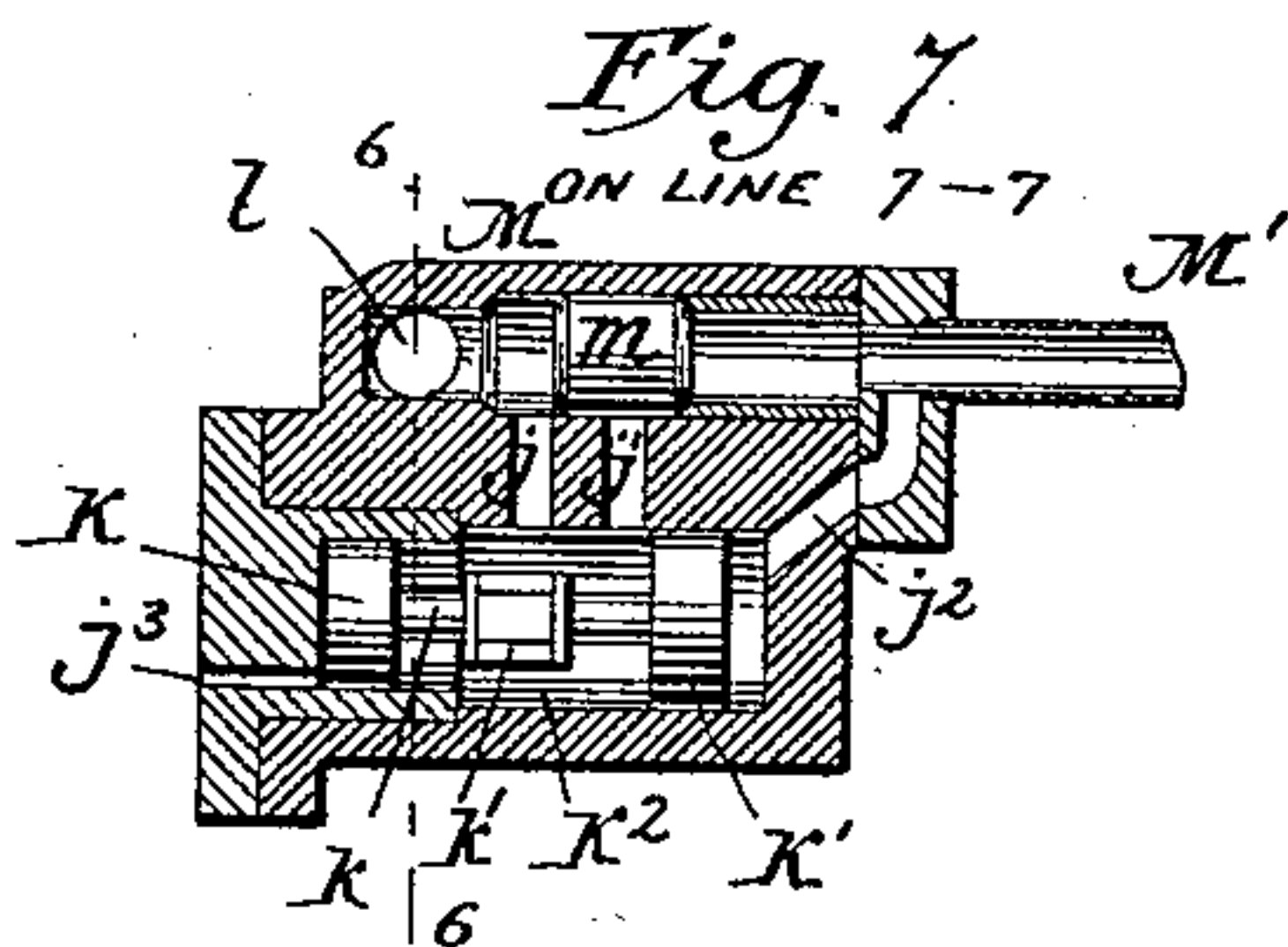
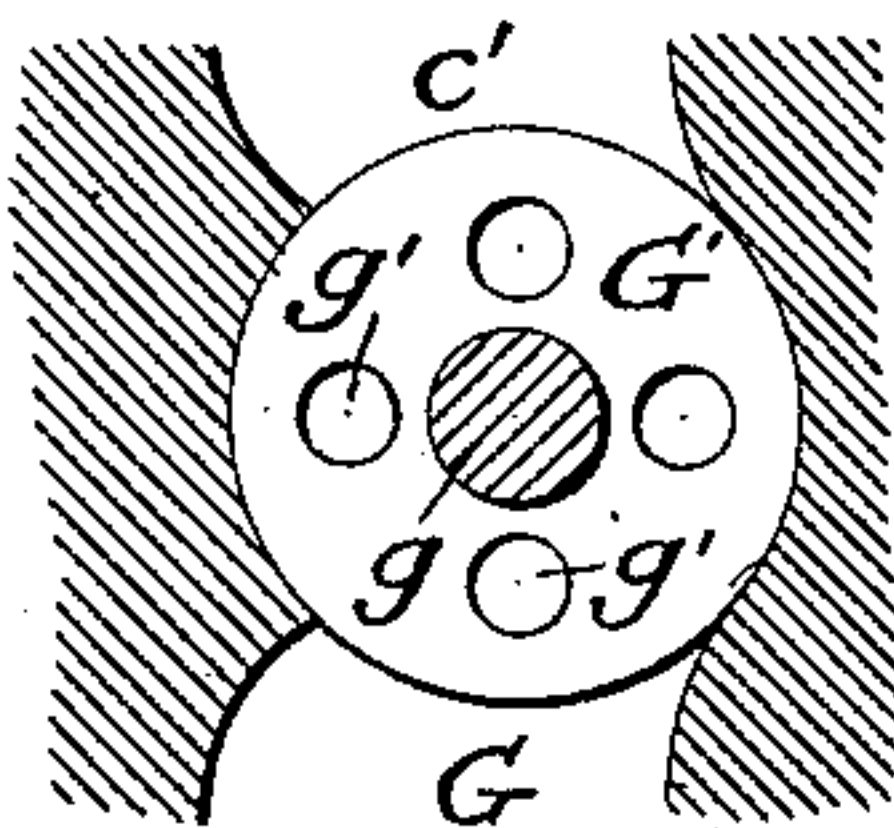


Fig. 8.

ON LINE 8-8



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UNITED STATES PATENT OFFICE.

ALBERT J. PITKIN, OF SCHENECTADY, NEW YORK.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 450,374, dated April 14, 1891.

Application filed January 7, 1891. Serial No. 376,986. (No model.)

To all whom it may concern:

Be it known that I, ALBERT J. PITKIN, a citizen of the United States, residing in the city and county of Schenectady, and State of New York, have invented certain new and useful Improvements in Compound Engines, of which the following is a specification.

My invention relates to compound engines of that class in which live or high-pressure steam simultaneously may be admitted to both cylinders or passed successively through one cylinder to the other. This end heretofore has been attained by means of a branched live-steam pipe and an intercepting-valve interposed between the cylinders and automatically actuated in one direction by the live steam to close it and in the other by the pressure of the steam in the low-pressure cylinder to re-establish this connection. United States Letters Patent No. 417,983, granted to me December 10, 1889, illustrate such an organization.

The objects of my present invention are, among other things, automatically to open and close the intercepting-valve by the direct action of live steam; to admit live steam to the low-pressure cylinder through a valve actuated by the intercepting-valve, instead of opening it by the direct pressure of the steam, and, finally, to open the intercepting-valve by steam-pressure from the receiver when the engine is running without pressure on the cylinders. These ends I attain by certain novel combinations and organizations of instrumentalities hereinafter claimed.

My improvements are applicable to either stationary, portable, or locomotive engines.

The accompanying drawings illustrate so much of an engine of the latter type as is necessary to illustrate the subject-matter claimed. Unless otherwise indicated, the parts are of usual well-known construction.

Figure 1 represents a front elevation, partly in vertical transverse section, showing the cylinders, their saddles, the smoke-box, the receiver, and intercepting-valve and steam-passages; Fig. 2, a horizontal transverse section through the intercepting-valve and other valves relating thereto on the line 2 2 of Figs. 1 and 4, showing the relation of the parts when the intercepting-valve is open; Fig. 3, a

similar view of some of the same parts in the position they assume when the intercepting-valve is closed; Fig. 4, a vertical longitudinal section through the intercepting-valve on the line 4 4 of Fig. 2 with the valve open. This figure is also a section on the line 3 3 of Fig. 1. Fig. 5 is a vertical transverse section through the regulating and intercepting valve actuating devices on the line 5 5 of Figs. 2 and 4; Fig. 6, a similar section on the line 6 6 of the same figures; Fig. 7, a vertical longitudinal section through the regulating devices on the line 7 7 of Figs. 1, 5, and 6; and Fig. 8, a vertical transverse section through the intercepting-valve on the line 8 8 of Fig. 4.

The feathered arrows indicate the direction in which the steam passes through the apparatus, while the short unfeathered darts in Fig. 2 show the movements of the regulating-valve and the actuating-piston of the intercepting-valve.

Fig. 1 shows a smoke-box A, mounted on saddles B C, respectively connected with a high-pressure cylinder D and low-pressure cylinder E, located on opposite sides of the engine and provided with suitable pistons and induction and eduction ports. (Not shown.) The exhaust-port of the high-pressure cylinder is connected by a pipe D' (shown in dotted lines in Fig. 1 and in full lines in Fig. 2) with a receiver F, the other end of which connects with the inlet-pipe E' of the low-pressure cylinder, in which the intercepting-valve G is located, and across which it reciprocates to open or close this passage.

The intercepting-valve and its appurtenant apparatus are shown as mounted on the saddle C of the low-pressure cylinder, while the live-steam connections and high-pressure exhaust devices are mounted on the other saddle B. The low-pressure exhaust-pipe E² lies centrally between them. The intercepting-valve G somewhat resembles that shown in my patent above mentioned, but differs therefrom in several details of construction, organization, and operation. It consists, essentially, of two pistons G' G², mounted at suitable distances apart and in fixed relation to each other on a stem g and provided with longitudinal perforations g' for the passage of live steam through these valves or pistons.

These valves traverse endwise a cylindrical chest C' , which is provided with ports $c' c^2$, opening into the low-pressure inlet-pipe E' , and with bearings c therein, in which the inner piston-head G^2 traverses. These bearings, in fact, constitute part of the valve-cylinder. A port or opening e in this valve-cylinder admits live steam direct to the low-pressure cylinder beneath the intercepting-valve, while the pressure of the steam in the receiver from the high-pressure cylinder acts in the contrary direction and on the upper side of the intercepting-valve when closed. Consequently the live steam, which exerts the greater pressure, compensates any looseness in the fitting of the valve by tending to press it upward against its seat when closed, thus preventing the live steam leaking into the receiver.

A piston-rod II , connected with the intercepting-valve, passes through suitable stuffing-boxes $h h'$ in the heads of the valve-chest and of a separate cylinder I , provided with a piston H' , which actuates the intercepting-valve. This actuating-cylinder I is provided with inlet-ports $i i'$ and an exhaust-port i^2 . The entrance of steam to this cylinder is controlled by a slide-valve k' on a stem k , carrying two pistons $K K'$, sliding in a chamber K^2 . Steam is admitted to this chamber through ports j, j' , and j^2 , the first two admitting steam between the pistons, while the other admits it to act upon the outer end of the larger piston K' , this piston being made larger than the other in order to insure its movement in the proper direction at the proper time. Live steam from the boiler passes through a pipe L directly to the high-pressure cylinder. A branch pipe L' from this pipe connects with a port l of an auxiliary regulating-chamber M , provided with a piston-valve m , which I call a "regulating-valve," traversing across the inlets $j j'$ of the regulating-chamber K^2 to open or close them at the proper time. A pipe M' connects the receiver F and its induction-pipe E' with this auxiliary valve-chamber M and with the port j^2 , Fig. 7, of the chamber K^2 , which is provided at its opposite end with an outlet j^3 for the escape of steam or water which may leak into that end of the chamber. The outlet i^2 of this chamber is contracted, as shown in Fig. 5, or provided with means for regulating the escape of the steam therefrom, so as to prevent the slamming of the piston H' and of the intercepting-valves actuated thereby.

A valve-chamber N contains a puppet-valve N' , having two seats $n n'$ and a stem N^2 , projecting outside the valve-chamber. A port n^2 admits steam to this valve-chamber from the live-steam branch pipe L' , and a passage n^3 permits its escape into the intercepting-valve cylinder C' , and thence through the port e to the low-pressure cylinder E below the intercepting-valve, as above mentioned.

An elbow-lever O , rocking on a fulcrum or pivot o , has its longer arm forked, so as to

embrace pins o' on the piston-rod II of the intercepting-valve. The other arm o^2 of this lever constitutes a tappet or wiper, which acts at the proper time on the stem of the puppet-valve N' to open it. This valve is so constructed that its outer member is of greater area than its inner. The preponderancy of pressure on the outer end of the valve tends to keep it closed when released from the wiper o^2 .

The relation of the wiper and valve-stem may be controlled either by adjusting the collar on its piston-rod or adjusting the wiper.

The operation of the apparatus is as follows: The normal relation of the parts when operating as a compound engine is that shown in Figs. 2 and 4, in which the intercepting-valve is opened and the admission of steam to the low-pressure cylinder, except through the high-pressure cylinder, receiver, and induction-port E' , is cut off. The apparatus is provided with suitable cut-off or throttle valves. (Not shown in the drawings.) To work both cylinders with high-pressure steam, a throttle-valve is opened, which permits live or high-pressure steam to pass through the branch pipe L' and port l to the auxiliary or regulating valve chamber M , the valve m of which it forces to the right, (see Fig. 7,) so as to open the port j and permit steam to pass into the valve-chamber K^2 between its pistons $K K'$. The right-hand one K' of these pistons being of greater area than the other, the steam-pressure forces them to the right from the position shown in Fig. 2 to that shown in Fig. 3. This movement causes the slide-valve k' to uncover the ports i of the cylinder I , which in turn forces the piston H' to the right, closing the ports $c' c^2$ of the intercepting-valve, as shown in Fig. 2. The relation of the parts is such that as the intercepting-valve closes the wiper o^2 strikes the stem N^2 of the puppet-valve N' and opens it, thus permitting high-pressure steam to pass from the pipe L' , through the passages $n^2 n^3$, into the intercepting-valve cylinder, and through the port e therein to the low-pressure cylinder E below the intercepting-valve, thus operating it with the full pressure of the live steam. The intercepting-valve, as before remarked, is already closed, and the tendency of the live steam is to press it upward in its seat, so as to prevent any leakage into the receiver and consequent back-pressure upon the high-pressure cylinder. The perforations g' in the intercepting-valve prevent the steam from exerting any endwise pressure upon it in either direction, and it is consequently entirely dependent upon the action of the live steam upon its piston II' in the actuating-cylinder I . The intercepting-valve should have sufficient lap to move slightly beyond its closing-point, in order that the opening of the supply-valve N' may not take place until the intercepting-valve is fully closed, the tappet o^2 being correspondingly adjusted. When it is desired to change from direct to

compound action, the live steam is cut off from the low-pressure cylinder. The pressure in the receiver and the induction-pipe E' then soon becomes sufficient to force steam through the return-pipe M' into the auxiliary chamber M and force the regulating piston-valve *m* into its seat, thus closing the ports *l* and *j* and simultaneously opening the port *j'*. The steam then passes through this last-named port and the port *j*² to opposite sides of the larger piston K', the result of which is to force the slide-valve *k'* to the left in the position shown in Fig. 2, which opens the exhaust *i*² and the inlet *i'* of the cylinder I and forces the piston H' to the left, thereby opening the intercepting-valve. This movement of the piston H' detaches the wiper *o*² from the puppet-valve N' and allows it to close quickly before the intercepting-valve opens. The parts having thus resumed the position shown in Fig. 2, the engine resumes its compound working. It will also be perceived from the foregoing description that the intercepting-valve will automatically be opened whenever the pressure in the receiver is sufficient to overcome that of the live steam in the auxiliary regulating-valve, and consequently it is not necessary even to cut off the live steam, unless it is desired, in order to open the valve quickly at any particular moment. The intercepting-valve will also be opened even when the steam is cut off, as in the case of a locomotive on a downgrade, should there be sufficient exhaust from the high-pressure cylinder to cause the requisite pressure in the receiver.

The operation may be concisely stated thus: The opening of the throttle admits live steam simultaneously to both the high and low pressure cylinders, and by means of this same live steam acting through a mechanism separate and distinct from the intercepting-valve itself the latter is automatically closed and the engine starts with its full power as a simple or non-compound engine. The steam-pressure thus caused in the receiver acts through the auxiliary regulating-valve *m* upon the slide-valve *k'* and opens the intercepting-valve, mechanism connected with which releases the valve controlling the admission of live steam to the low-pressure cylinder, which valve automatically closes itself, thus causing the parts to resume their compound working. The exhaust-steam does not move the intercepting-valve in either direction or exert any action upon it whatever.

Having thus fully described the construction, organization, and operation of my improved compound steam-engine, what I claim therein as new and as of my own invention is—

1. The combination, substantially as hereinafore set forth, of a high-pressure cylinder, a low-pressure cylinder, their connecting pipe or receiver, an intercepting-valve, its chest, its piston-rod, a separate cylinder, and a piston therein on the intercepting-valve rod

automatically actuated in both directions by the direct action of the steam in said cylinder to open and close the intercepting-valve. 70

2. The combination, substantially as hereinafore set forth, of a high-pressure cylinder, a low-pressure cylinder, their connecting pipe or receiver, an intercepting slide-valve therein, its valve-chest, its piston-rod, a separate cylinder, a piston therein on the intercepting-valve rod, and a slide-valve regulating the admission of steam thereto and automatically driven in both directions by the direct action of the steam therein. 80

3. The combination, substantially as hereinafore set forth, of a high-pressure cylinder, a low-pressure cylinder, their connecting pipe or receiver, an intercepting-valve therein, its chest, its piston-rod, a separate cylinder, a piston therein on the intercepting-valve rod, a slide-valve regulating the admission of steam thereto, and a steam-pipe connecting the receiver and actuating-valve chest, so as automatically to actuate the valve in both directions to open or close the intercepting-valve. 85 90

4. The combination, substantially as hereinafore set forth, of an intercepting-valve, a piston connected therewith, valve mechanism automatically controlling the movements of the piston, and regulating mechanism controlling the admission of live or high-pressure steam to the automatic valve mechanism and piston by the direct action of the steam upon the regulating mechanism. 95 100

5. The combination, substantially as hereinafore set forth, of an actuating-cylinder, its piston, its automatically-actuated valve mechanism, and mechanism automatically regulating the admission of steam to the valve mechanism and cylinder by the direct action of the steam upon the regulating mechanism. 105

6. The combination, substantially as hereinafore set forth, of an actuating-cylinder, its piston, its steam-ports, a slide-valve traversing these ports, pistons actuating the slide-valve, a regulating-chamber, a valve therein, and steam-ports on opposite sides thereof admitting steam simultaneously on opposite sides of one of the valve-pistons to control its movements. 110 115

7. The combination, substantially as hereinafore set forth, of a steam-cylinder, an intercepting-valve, means for actuating it automatically in either direction by the direct action of live or high-pressure steam, a valve controlling the admission of steam to the cylinder, and automatic mechanism actuated from the same source as the intercepting-valve to actuate the steam-inlet valve. 120 125

8. The combination, substantially as hereinafore set forth, of a high-pressure cylinder, a low-pressure cylinder, a receiver, an intercepting-valve, mechanism for actuating it automatically in both directions by the direct action of live or high-pressure steam, a valve, regulating the admission of steam thereto, 130

and steam-inlets on opposite sides of said valve respectively connected with the live-steam pipe and with the receiver, whereby the mechanism may automatically be actuated
5 either by the direct action of the live steam or by the pressure of that in the receiver.

9. The combination, substantially as here-
inbefore set forth, of a high-pressure cylinder,
a low-pressure cylinder, a receiver, an inter-
10 cepting-valve, its actuating mechanism, its regulating mechanism, a live-steam pipe admitting steam to the regulator, a pipe connecting the receiver and regulator, a valve controlling the admission of live steam to the
15 low-pressure cylinder, and automatic mechanism for positively opening said valve.

10. The combination, substantially as here-
inbefore set forth, of an intercepting-valve, mechanism automatically regulating its
20 movements, a valve admitting live steam to the intercepting-valve, and mechanism adapted to open it automatically, mechanically, and positively independently of the direct action of the steam thereon.

25 11. The combination, substantially as here-

inbefore set forth, of an intercepting-valve, its piston, a valve admitting live steam to the intercepting-valve, and mechanism controlled by the movements of the intercepting-valve positively, automatically, and mechanically
30 to open the steam-valve.

12. The combination, substantially as here-
inbefore set forth, of a high-pressure cylinder, a low-pressure cylinder, a receiver connecting them, a valve-casing therein, a longitudinally-
35 perforated intercepting-valve traversing said casing, a piston-rod connecting the intercepting-valve with an actuating-piston in a separate cylinder, a valve admitting live steam to the intercepting-valve, mechanism connected
40 with the piston for positively opening the valve, and a port in the intercepting-valve casing communicating with the low-pressure cylinder.

In testimony whereof I have hereunto sub-
scribed my name. 45

ALBERT J. PITKIN.

Witnesses:

ARTHUR M. LANE,
R. M. GIFFORD.