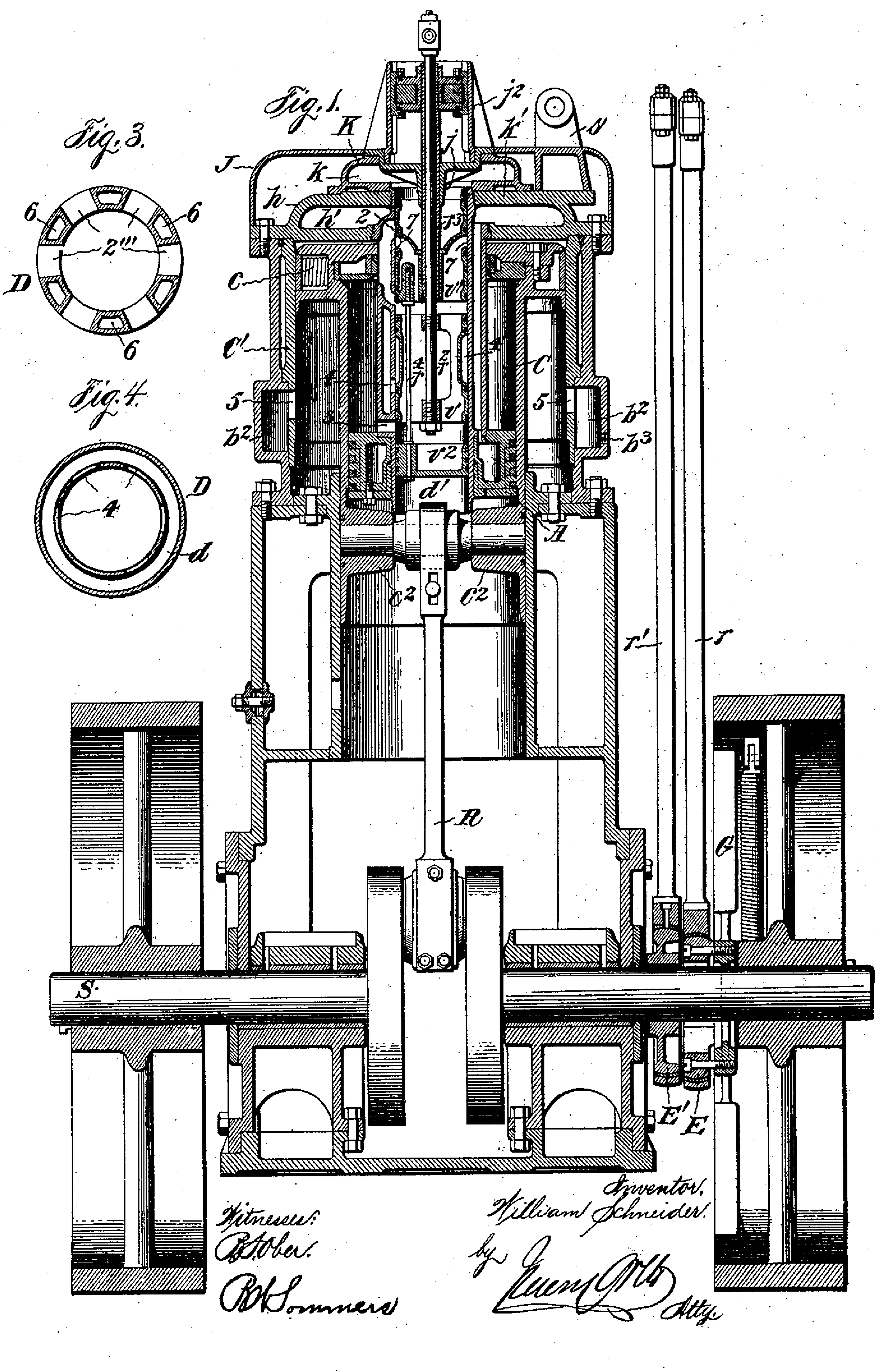
No. 690,620. Patented Jan. 7, 1902.

W. SCHNEIDER.

TELESCOPIC COMPOUND ENGINE.

(Application filed Mar. 14, 1901.)

(No Model.) 3 Sheets—Sheet 1.



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(No Model.) 3 Sheets—Sheet 2.

Fig. 2.

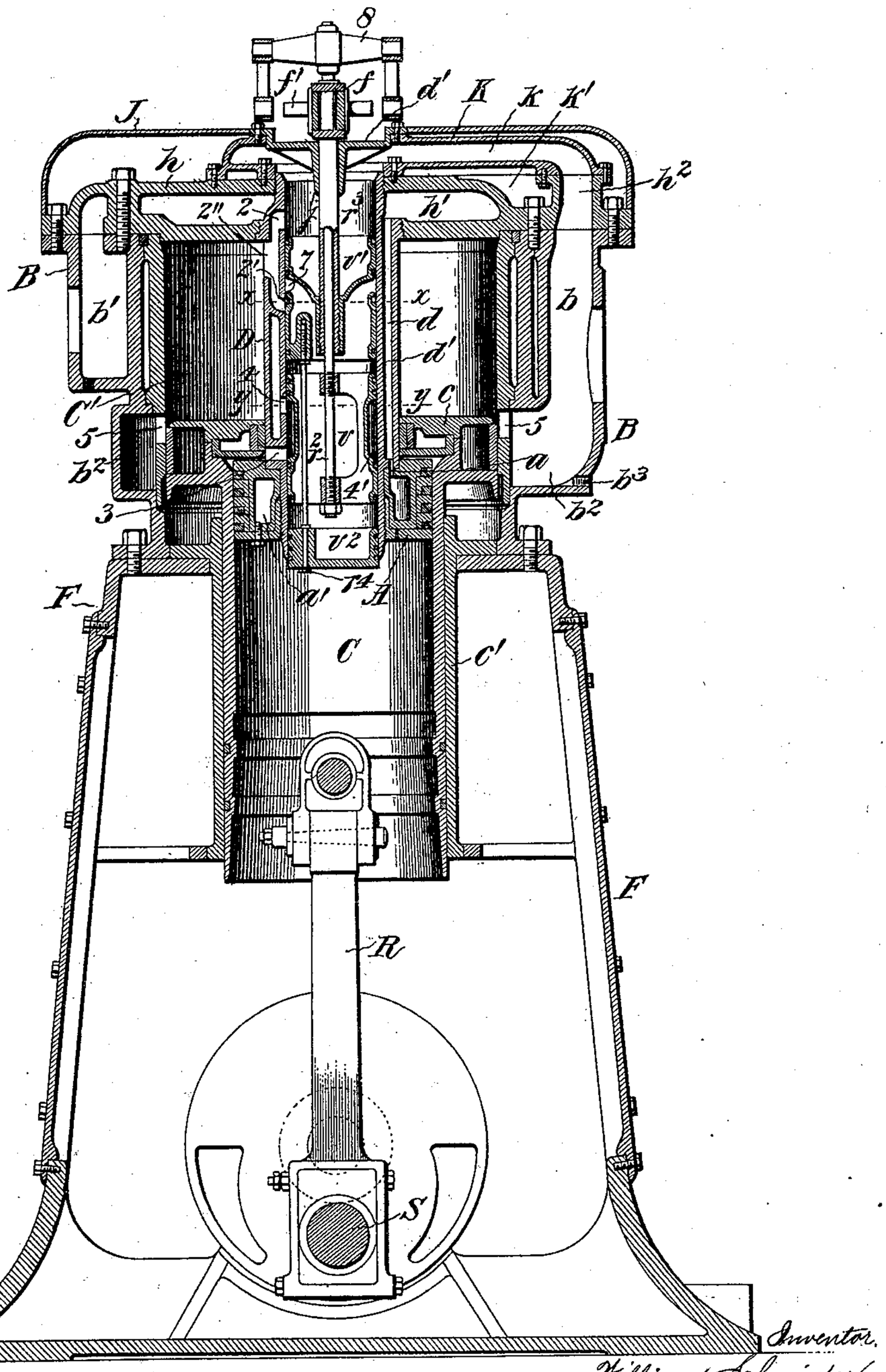

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Fig. 5.

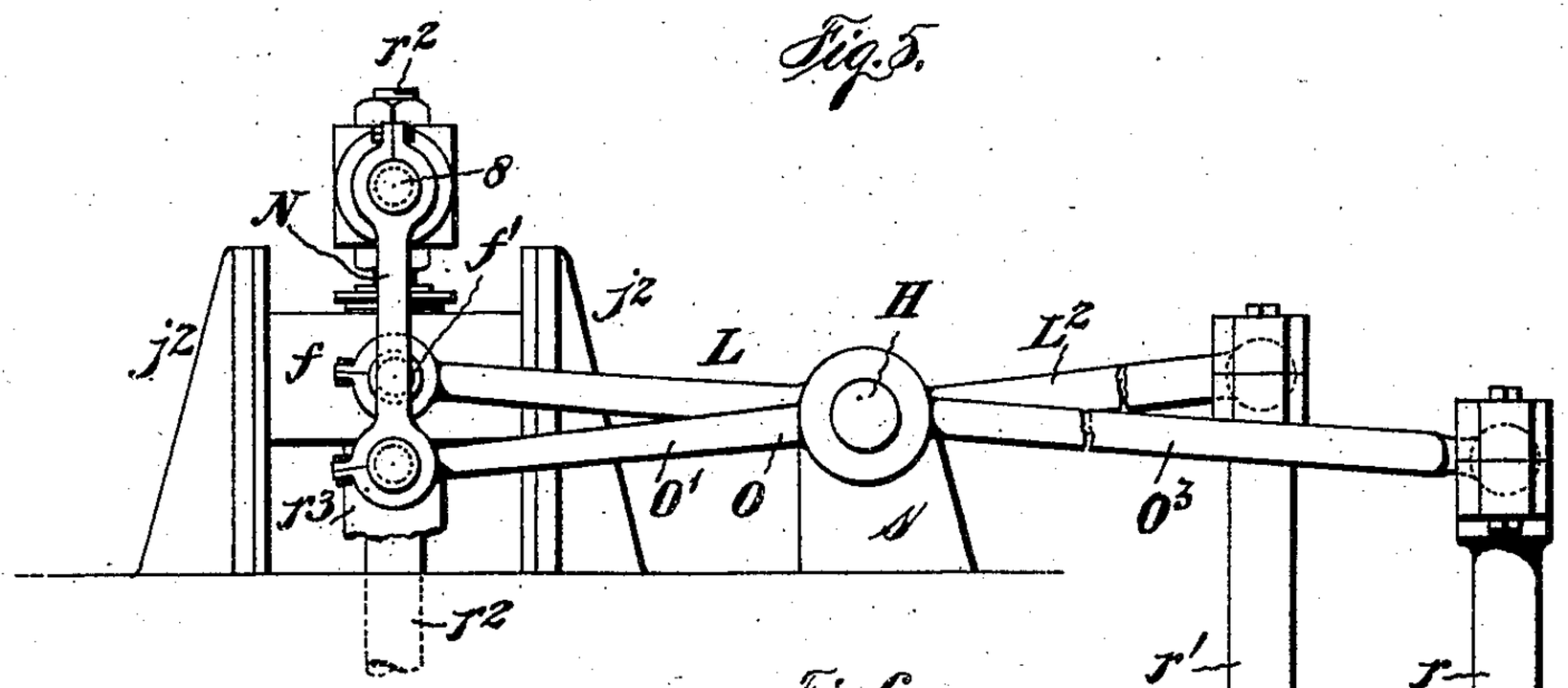
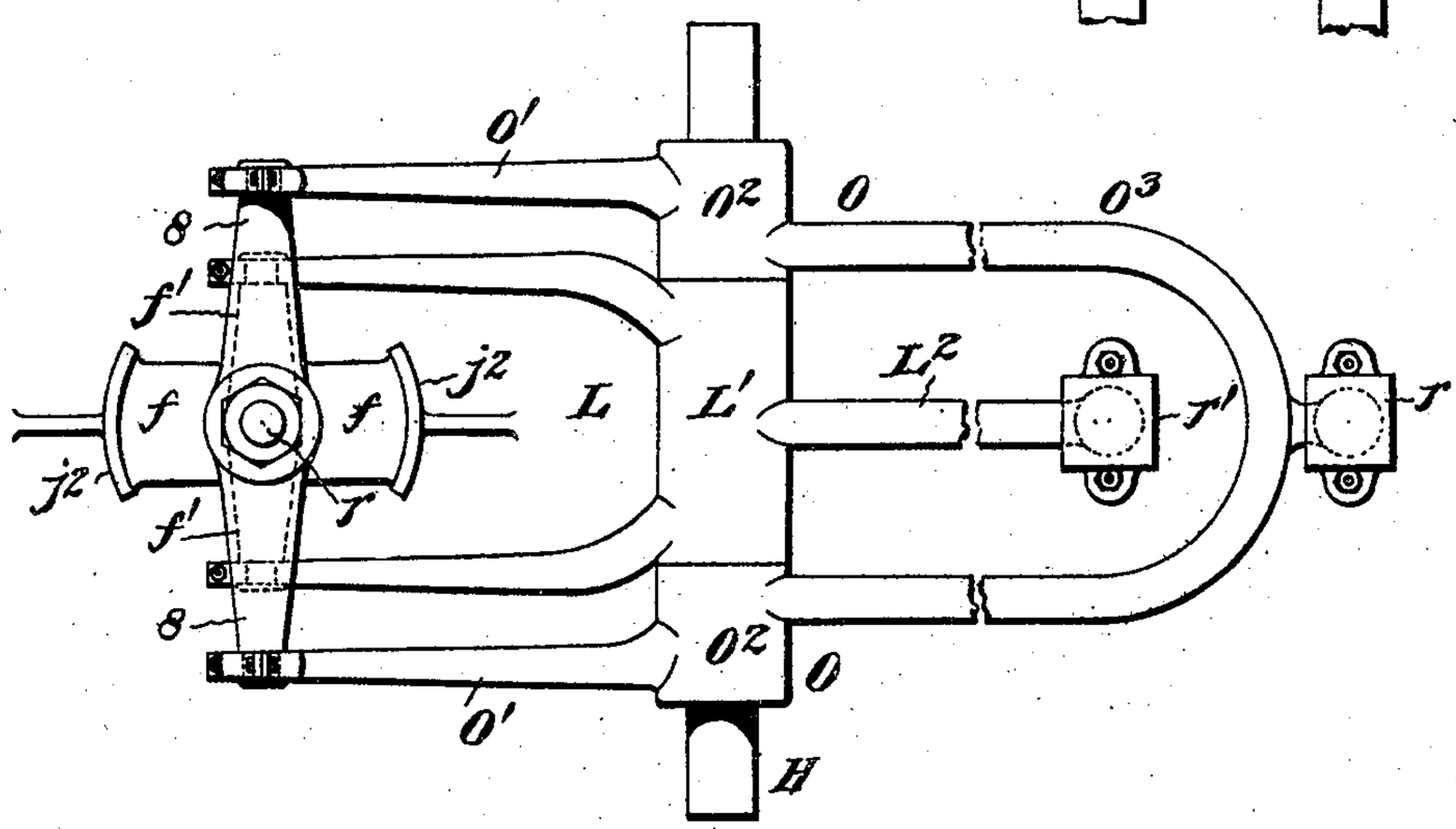


Fig. 6.



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UNITED STATES PATENT OFFICE.

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TELESCOPIC COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 690,620, dated January 7, 1902.

Application filed March 14, 1901. Serial No. 51,171. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM SCHNEIDER, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telescopic Compound Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

This invention has relation to that type of telescopic compound engine which comprises a low-pressure cylinder, a stationary abutment, and a high-pressure cylinder working in said low-pressure cylinder and on said abutment, the inner head of said high-pressure cylinder constituting the differential piston of the engine.

My invention has for its object to so construct the engine as to reduce the loss of steam and power by condensation and back pressure to a minimum, thereby correspondingly increasing the efficiency of the engine and proportionally reducing the cost of operating the same.

The invention has for its further object improvements in the valve mechanism and in the means for operating the valves.

These objects I attain in the manner and by the means as hereinafter fully described and as illustrated in the accompanying drawings, in which—

Figures 1 and 2 are vertical sections of a vertical compound telescopic engine embodying my improvements. Fig. 3 is a section of the combined steam-chest and valve-casing, taken on line $x\ x$ of Figs. 1 and 2. Fig. 4 is a section of the same, taken on line $y\ y$ of Fig. 2; and Figs. 5 and 6 are enlarged side elevation and plan views, respectively, of the connections between the valve-rods and their actuating-rods.

In Figs. 1 and 2, C′ indicates the low-pressure cylinder; C, the high-pressure cylinder, (both open at their lower or outer ends;) c, the inner head of the high-pressure cylinder and differential piston of the engine, and A the stationary abutment. The low-pressure cylinder is bolted to a suitable frame F, provided with the bearings for the crank-shaft S, to which frame is also bolted a tubular guide c' in the extension of said low-pressure cylinder, in which guide reciprocates the high-pressure cylinder C, provided with bearings c^2 for the pins on the cross-head, to which one end of the connecting-rod R is connected, the other end of which rod is connected in the usual manner with the wrist-pin of the crank on said crank-shaft. The upper head h of the low-pressure cylinder has formed therein a steam-chamber h', and the stationary abutment has a similar chamber a', and said abutment is detachably secured to and supported from a combined steam-chest and valve-casing D, hereinafter referred to as the "valve-casing," secured to the head of the low-pressure cylinder and arranged axially therein and extending through the differential piston c. In practice the connection between the abutment A and valve-casing D and the connection between the latter and the low-pressure cylinder-head are made by screw-joints, though any other means for detachably connecting said parts may be resorted to. Near its upper and lower ends the valve-casing is constructed in cross-section as shown in Fig. 3, the steam-passages 6 communicating with the steam-chamber h' in the head h of the low-pressure cylinder and the chamber a' in the abutment A, and between the passages 6, near the upper end of the casing D, are formed ports $2'''$, similar ports 3 being formed between the passages 6, near the lower end of said casing, said passages at the latter end of the casing communicating, as above stated, with the abutment-chamber a' through ports a. The passages $2'''$ (shown in cross-section, Fig. 3) between live-steam passages 6 serve to communicate ports $2''$ with ports $2'$ and also ports $2'$ with exhaust-ports 2. The valve-casing D, between the parts in which passages 6 are formed, is constructed in cross-section as shown in Fig. 4, the two concentric tubes forming between them an annular steam-chamber d, and the inner tube or valve-casing d' proper has ports 4 in communication

with said steam-chamber and auxiliary ports 2′, adapted to be placed in communication with ports 2.

On the low-pressure cylinder is mounted a casing B, provided with a live-steam passage b' for connection in any well-known manner with the source of live-steam supply and with an exhaust-passage b, which may be open to the atmosphere or connected with a condenser. The passage b' is in communication with the chamber h' in the head of the low-pressure cylinder C′, and at its lower end the casing B is of increased diameter to form an annular exhaust-chamber b^2, in communication with passage b and in communication with the low-pressure cylinder through exhaust-ports 5. The bolt-flange of the low-pressure-cylinder head h has a pipe-coupling h^2, in line with exhaust-passage b, and to the said cylinder-head h is bolted an exhaust-casing K, having a passage or pipe k bolted to pipe-coupling h^2, said casing being provided on its under side with suitable flanges, so as to form a dead-air chamber k' between casing K and head h. The casing K has a circular opening in line with and of greater diameter than the valve-casing D, so that the latter after being unscrewed from abutment A and from the head h of the low-pressure cylinder may be readily removed. To casing K is bolted a jacketing-casing J, which has a circular countersunk or depressed portion j', that serves as a closure for the opening in casing K, and said casing J carries the standards s for the rock-shaft, to which the valve-rods are connected.

From the description of the general construction of the engine it will readily be seen that the valve-casing and the high and low pressure cylinders are steam-jacketed in the most effectual manner, and owing to the fact that the valve-casing is completely surrounded by live steam during the operation of the engine the temperature of the low-pressure steam instead of being reduced is materially increased, so that condensation of steam, whether of high pressure or low pressure, is effectually reduced to a minimum.

The exhaust-chamber b^2 has a drainage-opening b^3, which is normally closed by a drain-cock. (Not shown.)

Referring now to the valve mechanism which controls the operation of the engine, v indicates the valve that controls the admission of live steam to the high-pressure cylinder and hereinafter referred to as the "distributing-valve," and v' indicates the exhaust-valve, that controls the exhaust from both high and low pressure cylinders, both valves being tubular, as shown, and v^2 is the lower head for said valves, which closes the lower end of the valve-casing steam-tight. The distributing-valve v has a contracted or reduced portion, forming with the valve-casing an annular live-steam chamber 4′, adapted to communicate with the steam-chest d through ports 4, above referred to. The exhaust-valve v' has secured thereto, so as to move therewith, the lower valve-head v^2 by means of two or preferably three rods r^4, and said valve is secured to a tubular valve-rod r^3, guided in a bearing j, formed on the part j' of casing J. The valve-rod r^3 extends through and moves with a cross-head f, guided in guides j^2 on casing J, and said cross-head has journals f' connected to the ends of the arms of a bifurcated lever L, whose bearing-sleeve or long hub L′ is loosely mounted on a shaft H, having its bearings in standards s on casing J. The hub L′ of lever L has a radial arm L^2, connected by ball-and-socket joint with the connecting-rod r', that connects the said tubular valve-rod r^3 with the eccentric E′ on crank-shaft E. (See Figs. 5 and 6.) Through the connections described the exhaust-valve and valve-head v^2 move in unison in the inner tube d' of the valve-casing D.

The distributing-valve v is secured to a valve-rod r^2, that extends through the aforementioned tubular valve-rod r^3 and has motion independently thereof, said valve-rod r^2 having secured to its upper end a journal-block provided with radial arms S, connected by links N to arms O′ of a bifurcated lever O, having hubs or bearing-sleeves O^2 loosely mounted on shaft H on opposite sides of the hub L′ of lever L. The lever O has a U-arm O^3, connected by ball-and-socket joint with the connecting-rod r, which latter is connected to eccentric E on engine-shaft S. (See Figs. 5 and 6.) The eccentric E is controlled by a suitable governing device, preferably the well-known Rites governor G, mounted on fly-wheel W, to automatically vary the travel of the distributing-valve and the cut-off according to the speed of the engine.

The operation of the engine is as follows: In Fig. 1 the high-pressure piston-cylinder is shown at the limit of its up or in stroke, steam exhausting from the high-pressure cylinder C into the low-pressure cylinder C′ not only through ports 3, valve-casing ports 2′, and long ports 2″, but also direct through said long ports 2″, the high-pressure piston-cylinder making its down or out stroke under expansion. As the high-pressure piston-cylinder completes its down or out stroke its piston uncovers ports 5, leading to exhaust-chamber b^2, the distributing-valve v establishes communication between the steam-chest d and valve-casing d' and between the latter and the high-pressure cylinder through ports 3, while the exhaust-valve at the same time uncovers ports 2, allowing steam from low-pressure cylinder to exhaust also through said ports, the valve-casing, and through passage k in exhaust-casing K into exhaust-passage b, as shown in Fig. 2. It will thus be seen that the exhaust from the low-pressure cylinder takes place at both ends thereof simultaneously, and the object of this is to utilize the heat of the exhaust-steam to prevent cooling of the low-pressure cylinder, and consequently to prevent condensation of

steam therein during the low-pressure stroke, while at the same time the steam in low-pressure cylinder at the completion of the low-pressure stroke is more rapidly exhausted than would be the case otherwise. Hence there is a reduction of resistance to the in-stroke of piston *c*. Of course the exhaust through ports 5 is, practically speaking, but momentary, yet, as shown, these ports are of considerable vertical area. Hence exhaust takes place a little before, and until the high-pressure cylinder has reached the limit of its low-pressure stroke a comparatively large volume of steam exhausts through ports 5 before the piston *c* again covers said ports on the high-pressure stroke. This arrangement of ports 5 and 2 results in attaining a desirable and independent lead in exhausting, irrespective of the lead or lap of the valves. In view of the construction and relative arrangement of the valves *v* and *v'* and valve-head v^2 it will readily be seen that the valve-casing *d'* performs the function of receiver.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. A telescopic compound engine, comprising a low-pressure cylinder, a stationary abutment and a high-pressure piston-cylinder working in said low-pressure cylinder and on said abutment, an exhaust-chamber encompassing one end of the low-pressure cylinder, an exhaust-chamber at the opposite end thereof and ports leading from said cylinder to said exhaust-chambers; in combination with means controlling said ports to cause steam to exhaust into both chambers on the low-pressure stroke of the piston-cylinder, for the purposes set forth.

2. In a telescopic compound engine, the combination with the low-pressure cylinder having a chambered head, a chambered stationary abutment, the high-pressure piston-cylinder working in said low-pressure cylinder and on said abutment, and a casing on the low-pressure cylinder having a live-steam chamber in communication with the chamber in the low-pressure-cylinder head, an exhaust-chamber above said head, and a second exhaust-chamber encompassing the opposite end of said low-pressure cylinder, and ports leading therefrom to said exhaust-chambers, the ports leading to the encompassing exhaust-chamber being controlled by the movements of the piston; of a valve-casing, a steam-chest surrounding the same in communication with the chambers in the head of the low-pressure cylinder and in the piston-abutment, ports leading from the valve-casing to the high and low pressure cylinders and valves controlling said ports to cause the engine to work compound, for the purposes set forth.

3. A telescopic compound engine, comprising a low-pressure cylinder, a stationary abutment, a high-pressure piston-cylinder working in said low-pressure cylinder and on said abutment, an exhaust-chamber encompassing one end of the low-pressure cylinder, an exhaust-chamber at the opposite end thereof, an air-chamber between the last-named exhaust-chamber and said low-pressure cylinder and ports leading therefrom to said exhaust-chambers; in combination with means controlling said ports to cause steam to exhaust from the low-pressure cylinder into both exhaust-chambers on the low-pressure stroke, for the purposes set forth.

4. In a compound telescopic engine organized as described, the combination with the high and low pressure cylinders, the stationary abutment, the axially-disposed valve-casing provided with ports as described and the steam-chest surrounding said casing and communicating therewith through ports 4; of the valves *v v'*, the valve-head v^2 connected with valve *v'*, a tubular valve-rod to which the latter valve is secured, an eccentric on the crank-shaft connected with said valve-rod, a second valve-rod carrying valve *v* and extending through the aforesaid tubular valve-rod, and an automatic eccentric on aforesaid crank-shaft connected with the rod of valve *v*, for the purposes set forth.

5. A steam-engine comprising a low-pressure cylinder having a live-steam-supply chamber connectible with the boiler formed in one of its heads, a stationary abutment, and a high-pressure cylinder working in said low-pressure cylinder and on said abutment; in combination with a steam-chest connected with said abutment and opening into the chamber in said cylinder-head, a tubular valve-casing concentric with the steam-chest and extending through the steam-chamber in the head of the low-pressure cylinder, suitable distributing ports and passages in said chest and casing, and suitable valves in the latter controlling said ports and passages, for the purpose set forth.

6. A steam-engine comprising a low-pressure cylinder, a stationary abutment, a high-pressure cylinder working in said low-pressure cylinder and on said abutment, and a valve-casing extending from said abutment through the opposite head of the low-pressure cylinder; in combination with a jacketed exhaust-chamber on said head having an opening in line with and of greater diameter than that of said valve-casing, a removable cover for said opening and a distributing-valve in the valve-casing whose stem extends through said cover, for the purposes set forth.

7. The combination with the low-pressure cylinder of a telescopic engine organized as set forth, the axially-arranged valve-casing, and the exhaust-chamber on the head of said low-pressure cylinder, said exhaust-chamber having an opening in line with and of greater diameter than that of said valve-casing; of the jacketing-casing J constructed to close the opening in said exhaust-chamber and carrying the bearings for the valve-rods and for the shaft that carries the rock-levers for said

rods and also the cross-head guide for one of said valve-rods, substantially as and for the purposes set forth.

8. In a telescopic compound engine, the combination with the low-pressure cylinder, a stationary abutment and the high-pressure piston-cylinder working on said abutment and in said low-pressure cylinder; of means for exhausting the steam from opposite points of the high-pressure piston-cylinder into the low-pressure cylinder on the low-pressure stroke, for the purpose set forth.

9. In a telescopic compound engine, the combination with the low-pressure cylinder, the stationary abutment and the high-pressure piston-cylinder working on said abutment and in said low-pressure cylinder, said high-pressure cylinder extended beyond the packing on the abutment; of a tubular guide for the high-pressure cylinder carried by and in extension of the low-pressure cylinder, for the purposes set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

WILLIAM SCHNEIDER.

Witnesses:
JOHN M. WALLACE,
O. A. WACHS.