

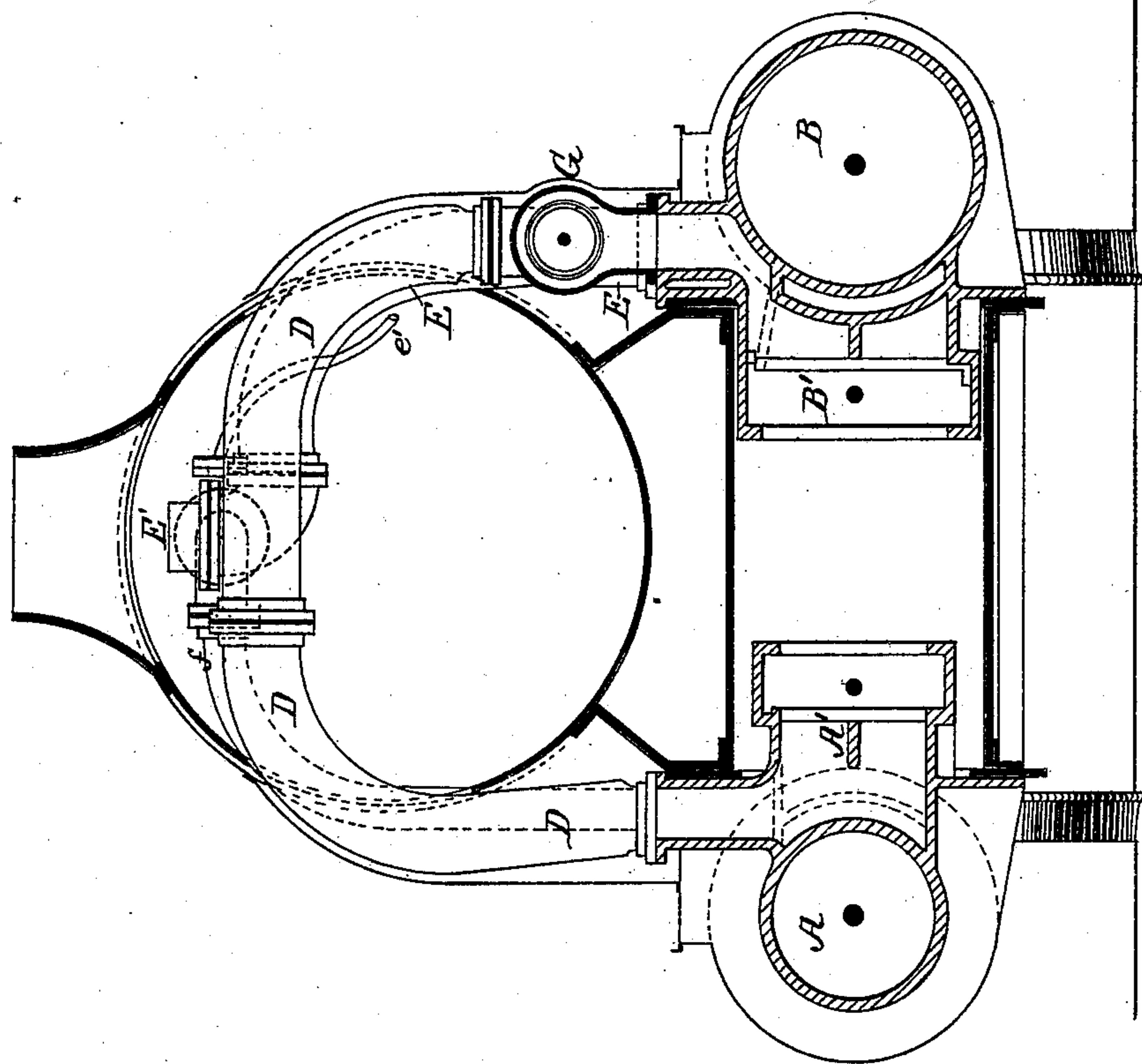
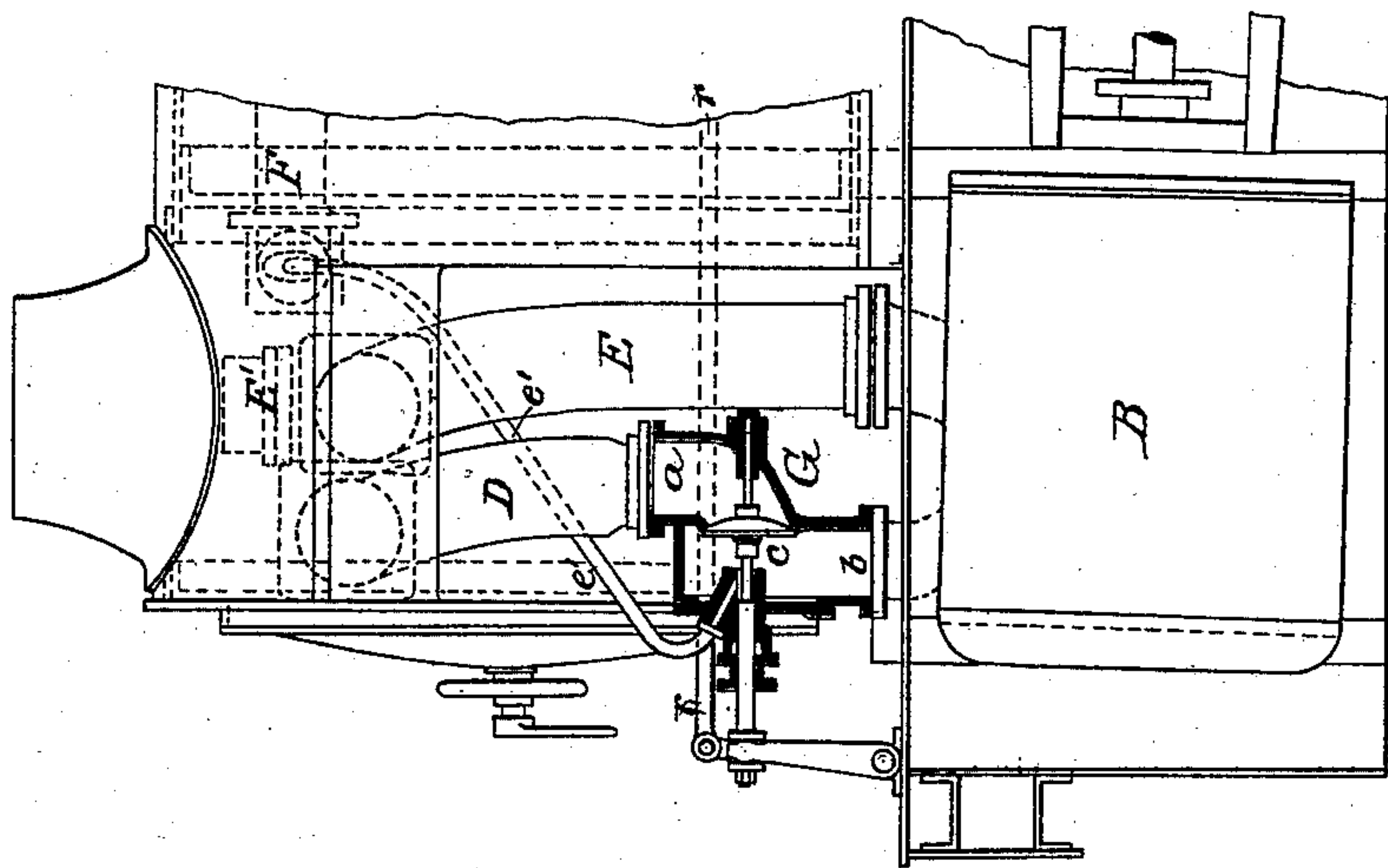
(No Model.)

2 Sheets—Sheet 1.

A. VON BORRIES.  
COMPOUND LOCOMOTIVE.

No. 361,471.

Patented Apr. 19, 1887.



Witnesses:  
William F. Davis  
John E. Parker

Inventor:  
August von Borries  
by his Attorneys  
Howen & Kirs

(No Model.)

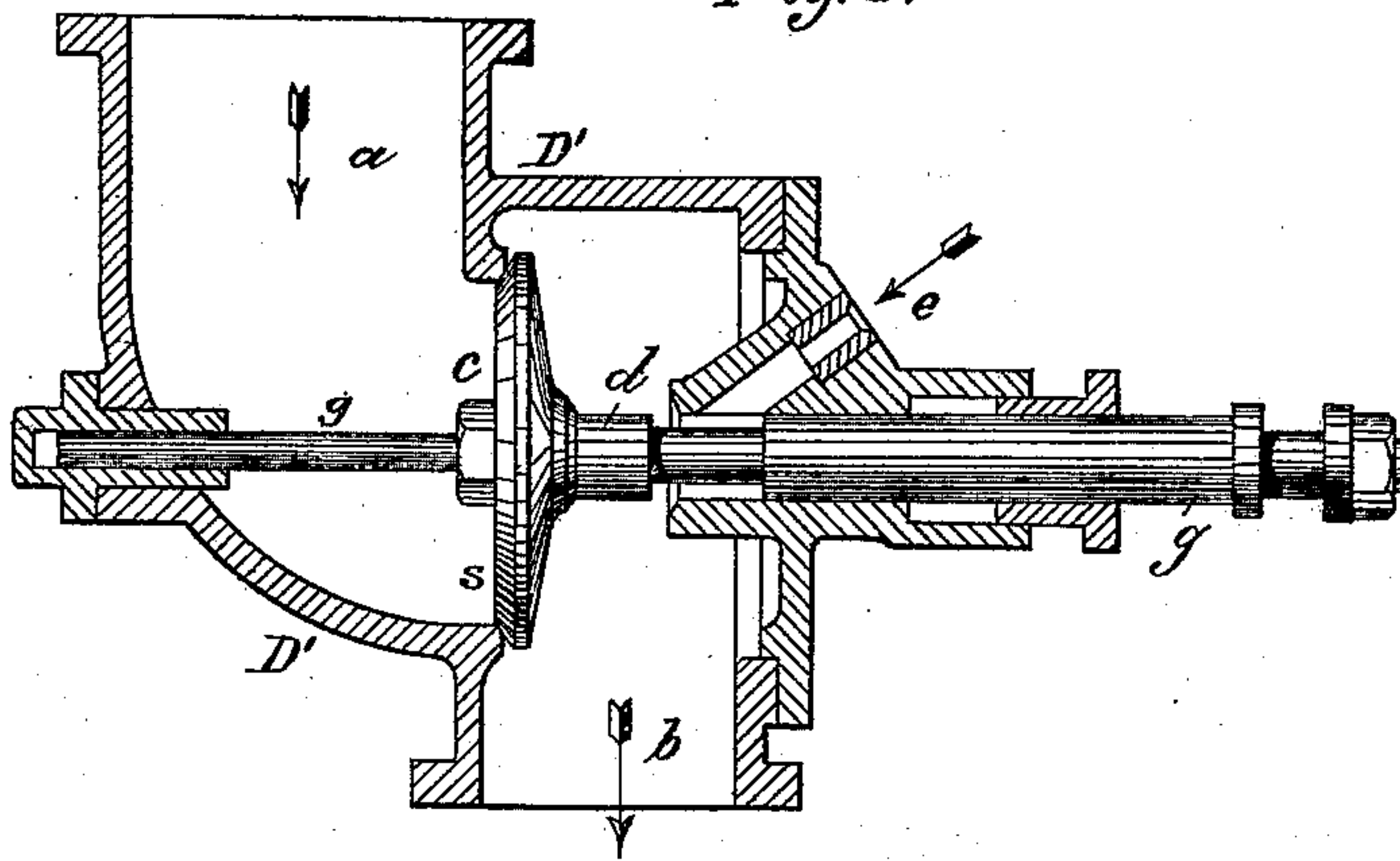
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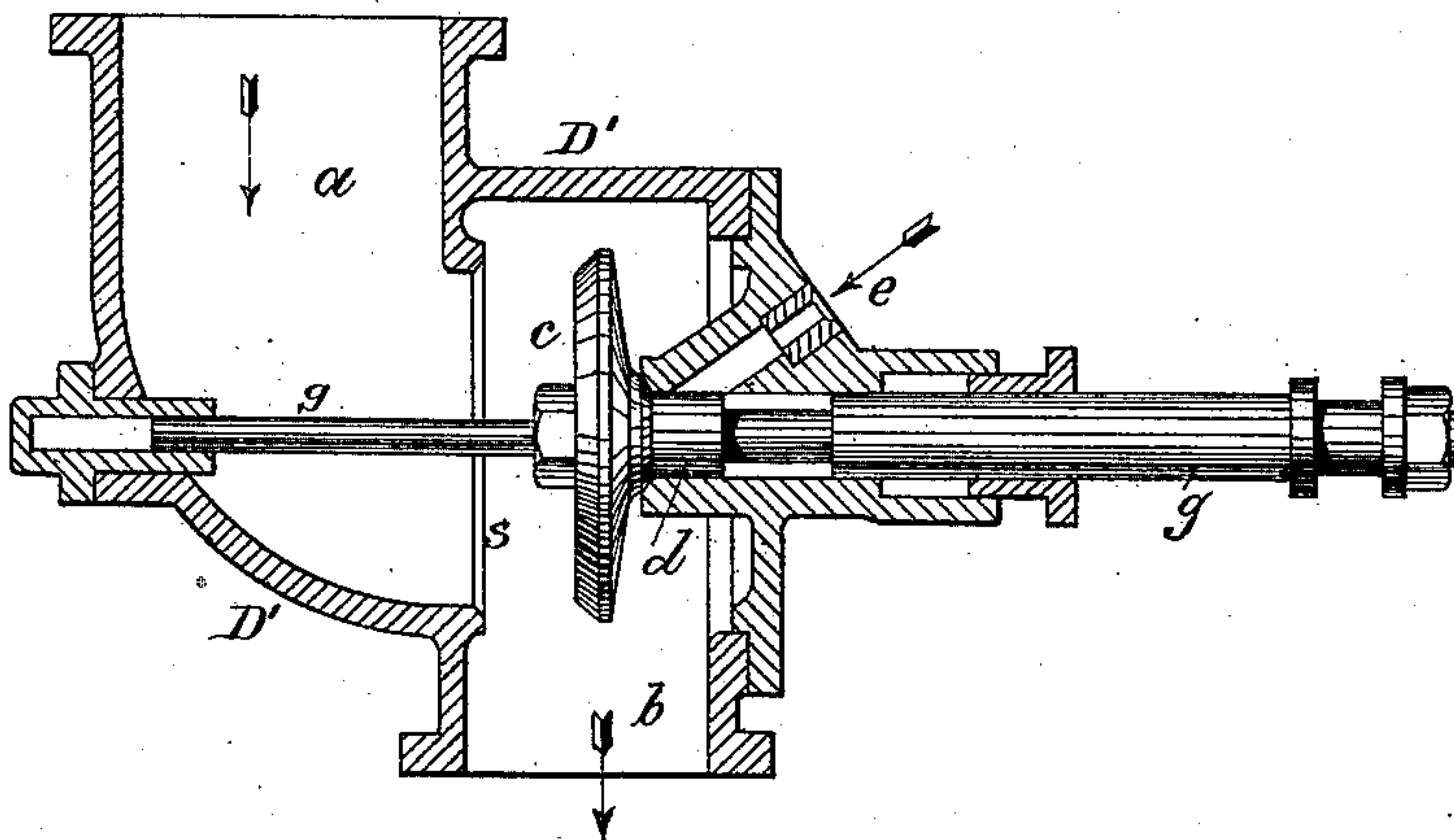
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*Fig. 3.*



*Fig. 4.*



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Horsman and Law



# UNITED STATES PATENT OFFICE.

AUGUST VON BORRIES, OF HANOVER, PRUSSIA, GERMANY.

## COMPOUND LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 361,471, dated April 19, 1887.

Application filed December 30, 1885. Serial No. 187,137. (No model.) Patented in Germany October 23, 1884, No. 31,340; in France November 28, 1884, No. 165,637; in Belgium November 28, 1884, No. 67,044; in England November 28, 1884, No. 15,699; in Italy December 31, 1884, XXXV, 52; in Austria-Hungary March 3, 1885, No. 35,326, XIX, 286, and in Denmark May 4, 1885, No. 2,179.

*To all whom it may concern:*

Be it known that I, AUGUST VON BORRIES, a subject of the King of Prussia, residing at Hanover, Prussia, Germany, have invented certain  
5 new and useful Improvements in Compound Engines, (for which I have obtained a German patent dated October 23, 1884, No. 31,340; Danish patent, May 4, 1885, No. 2,179; Austro-Hungarian patent, March 3, 1885, No. 35,326;  
10 Italian patent, December 31, 1884, No. XXXV, 52; French patent, November 28, 1884, No. 165,637; Belgian patent, November 28, 1884, No. 67,044, and British patent, No. 15,699, November 28, 1884,) of which the following is a specification.

My invention is more especially adapted for use on locomotives of the compound-engine type, although it is applicable to other compound steam-engines; and the object of my invention is to so construct a compound locomotive or other engine that the connection between the cylinders can be cut off and both  
20 be worked at high pressure when desired. This object I attain by combining with the connecting-pipe between the two cylinders an automatic valve and a communication with the steam-pipe, as hereinafter fully described.

In the accompanying drawings, Figure 1 is a vertical section through the front end of a  
30 locomotive to which my improvements have been applied. Fig. 2 is a side view of the same, showing the valve-chest of my attachment in section. Fig. 3 is an enlarged sectional view of the attachment, showing the valve closed; and Fig. 4 is a corresponding view showing  
35 the valve open.

Referring to Figs. 1 and 2, A is the small high-pressure cylinder, and B the large low-pressure cylinder, of the compound engine, arranged on opposite sides of the locomotive, as  
40 the ordinary cylinders are. The exhaust of the valve-chest A' of the high-pressure cylinder A communicates with the steam-chest B' of the low-pressure cylinder through a connection-pipe or receiver, D, while the exhaust from the cylinder B communicates through the  
45 pipe E, Fig. 2, with the usual exhaust-nozzle, E'.

The high-pressure cylinder A receives the steam from the steam-supply pipe F through  
50 a pipe, f, as usual.

In using locomotives it is desirable in starting, especially with heavy trains, or in ascending steep grades, to exert the greatest possible power for a short time, and then to allow the  
55 engine to run under normal conditions. When the locomotive-engine is of the compound type, it is for this purpose desirable to work both cylinders at high pressure for a little time. I therefore place in the pipe between  
60 the two cylinders an automatic valve, G, Figs. 1 and 2, the construction and operation of which will be more fully seen on reference to Figs. 3 and 4. In these figures, the opening a of the chest, D', containing this valve,  
65 leads from the high-pressure cylinder, while the opening b connects with the steam-chest of the low-pressure cylinder. Between the two is the valve-seat s for the valve c, which is carried by the spindle g, adapted to be moved  
70 longitudinally to open or close the valve. In the cover of this valve-chest D' is a passage, e, with which communicates a pipe, e', Fig. 2, leading from the steam-pipe F. This passage  
75 e opens into the aperture through which the spindle g passes, and this spindle has a reduced portion at that point, leaving a shoulder or valve, d, of such a character that when the  
80 valve c is closed there will be a communication opened between the steam-pipe e' and the passage b leading to the low-pressure cylinder. On raising the valve c some distance from its seat, however, the communication between the  
85 pipe e' and the passage b will be closed, as shown in Fig. 4. The spindle g, carrying the valve c, is placed under the control of the engineer through a rod, r, Fig. 2, or any other  
suitable means.

In starting the locomotive the engineer closes the valve c to its seat, as shown in Fig. 3.  
90 Communication is thus cut off between the two cylinders A and B, and there can be then no back-pressure on the piston of the high-pressure cylinder from the steam of the low-pressure cylinder. Steam from the main steam-  
95 valve is admitted through the passage e for

working the piston of the cylinder B direct, and thus getting the greatest possible power for a short time.

5 The valve *c* remains closed until pressure of exhaust-steam from the cylinder A becomes a little greater in the pipe D than that in the steam-chest of the cylinder B, when the valve *c* will automatically open and shut off the supply of steam from the pipe *e'*, as indicated in  
10 Fig. 4. The engine is then run on the compound system, and the valve *c* will remain open owing to the greater surface exposed to the action of steam on the side of the valve adjacent to the passage *a*.

15 When the engineer wishes to work both cylinders by direct pressure again, he closes the valve *c*.

I claim as my invention—

The combination of the high and low press-

ure cylinders of a compound engine and a 20 connecting-pipe or receiver for conveying the exhaust from the high-pressure cylinder to the low-pressure cylinder, with a valve-chest in said pipe, a live-steam passage, *e*, to the low-pressure cylinder, a valve, *d*, for said passage, 25 and a valve, *c*, between the two cylinders, the two valves being in the same valve-chest and connected, so that the valve *d* closes as the valve *c* opens automatically under the pressure of the exhaust, all substantially as set 30 forth.

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

AUGUST VON BORRIES.

Witnesses:

WILLIAMS C. FOX,

JOH. KRACKE.