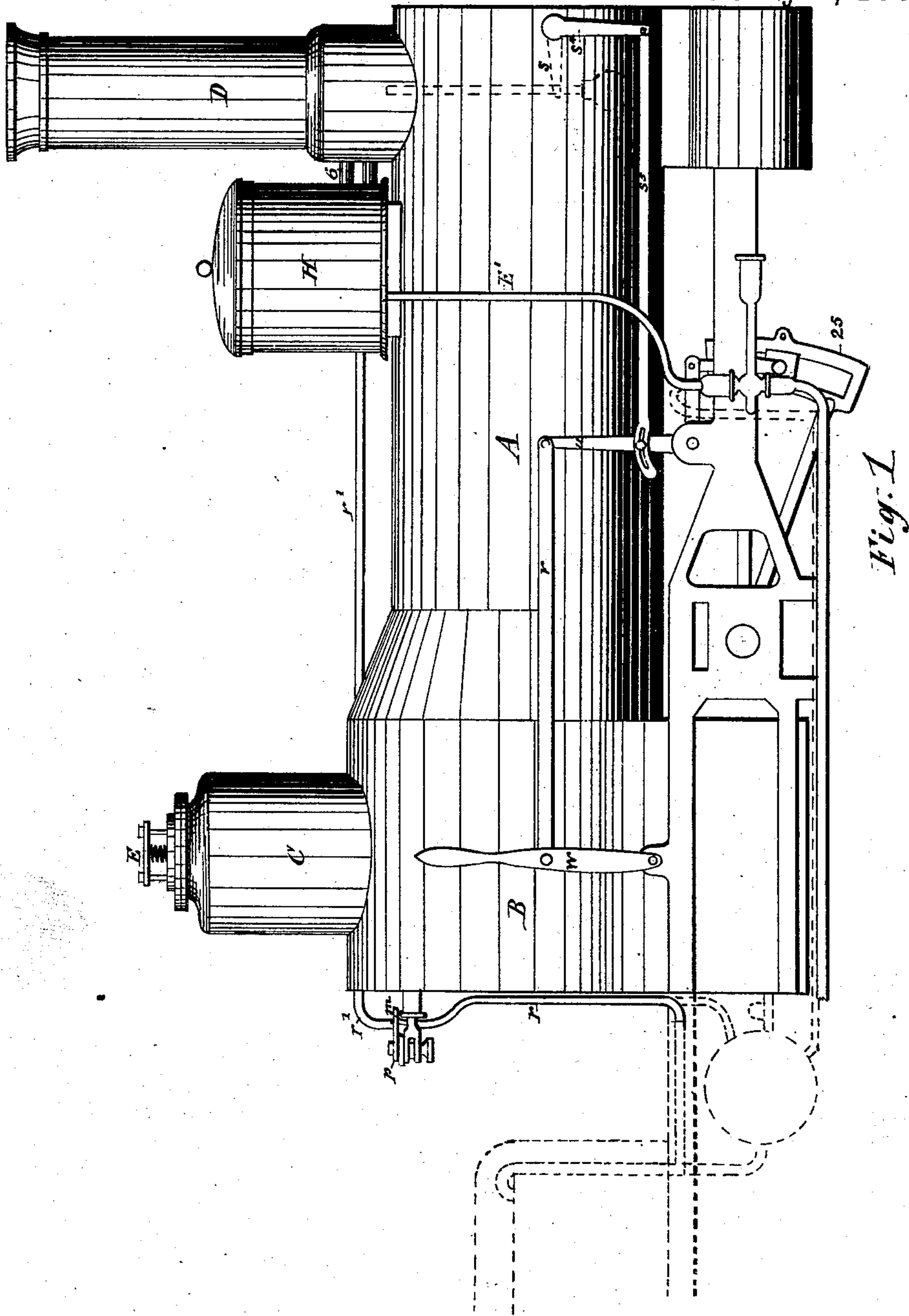


H. WATKEYS.

VARIABLE EXHAUST OF STEAM ENGINES.

No. 260,433.

Patented July 4, 1882.



WITNESSES

E. Laass

C. Bendixen

INVENTOR

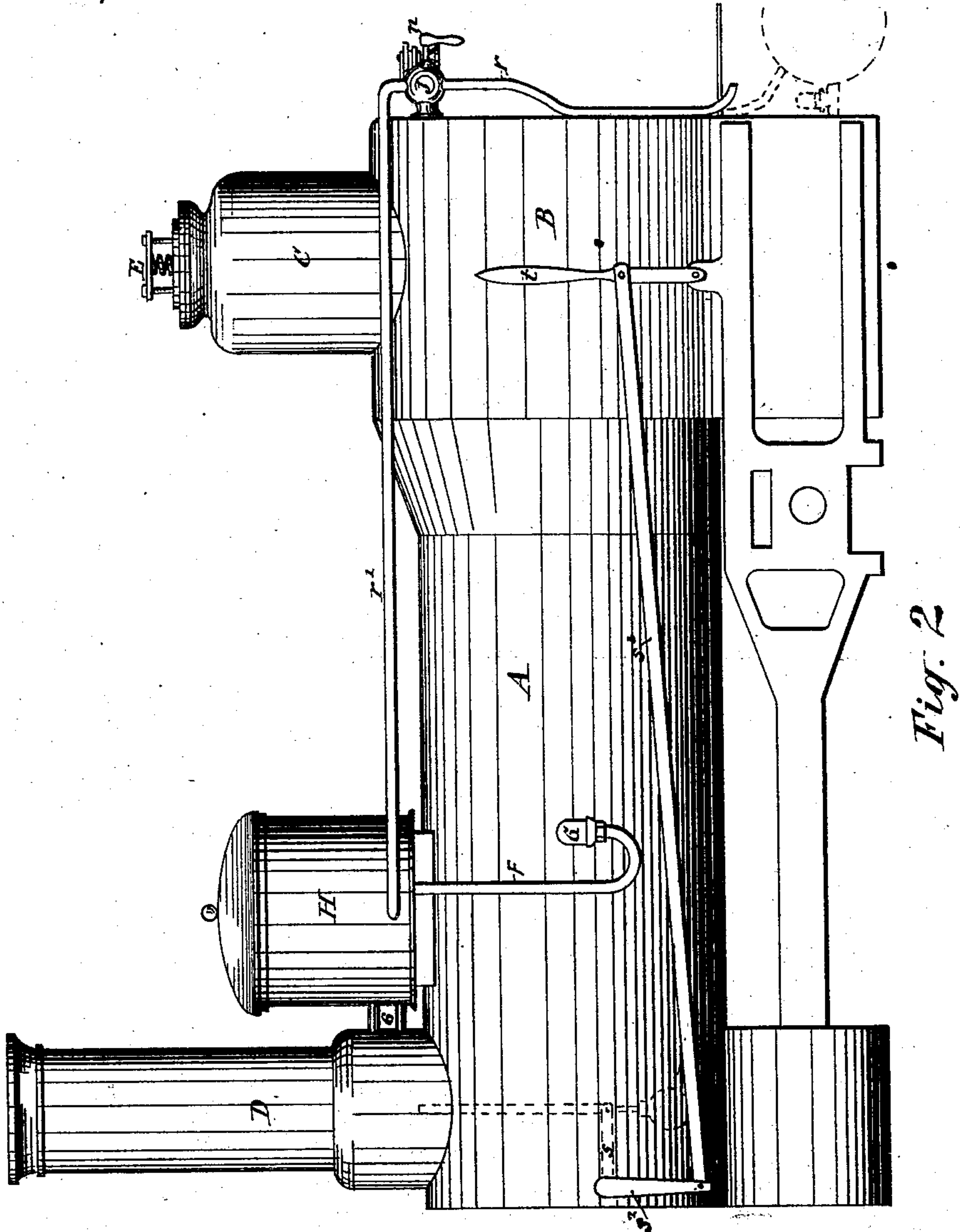
Henry Watkeys  
for Duell, Laass & Henry  
Attorneys

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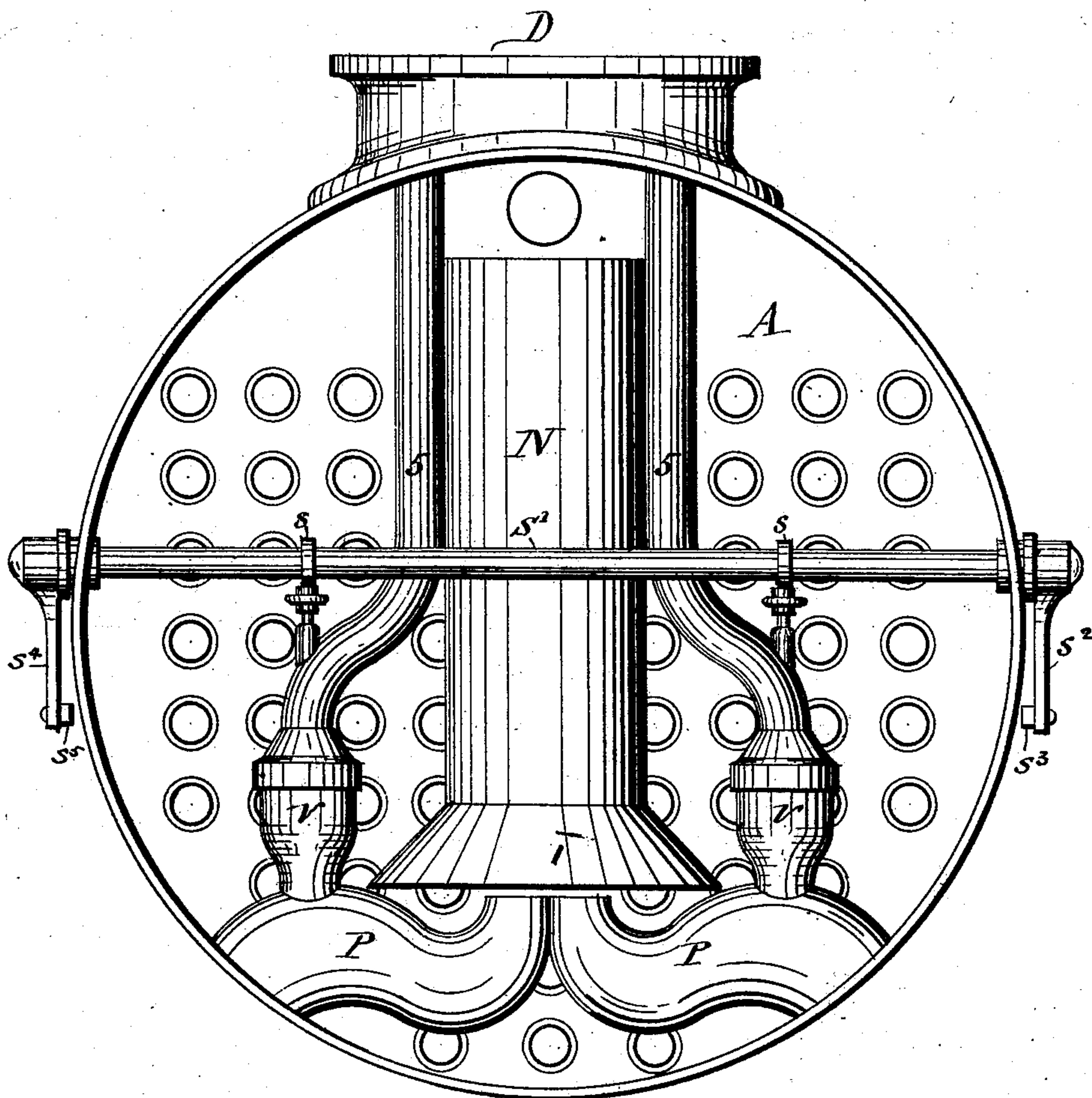


Fig. 3

Witnesses—

Wm. C. Raymond.

C. H. Duell

Inventor—

Henry Watkeys

per. Duell, Laas & Key  
Attorneys

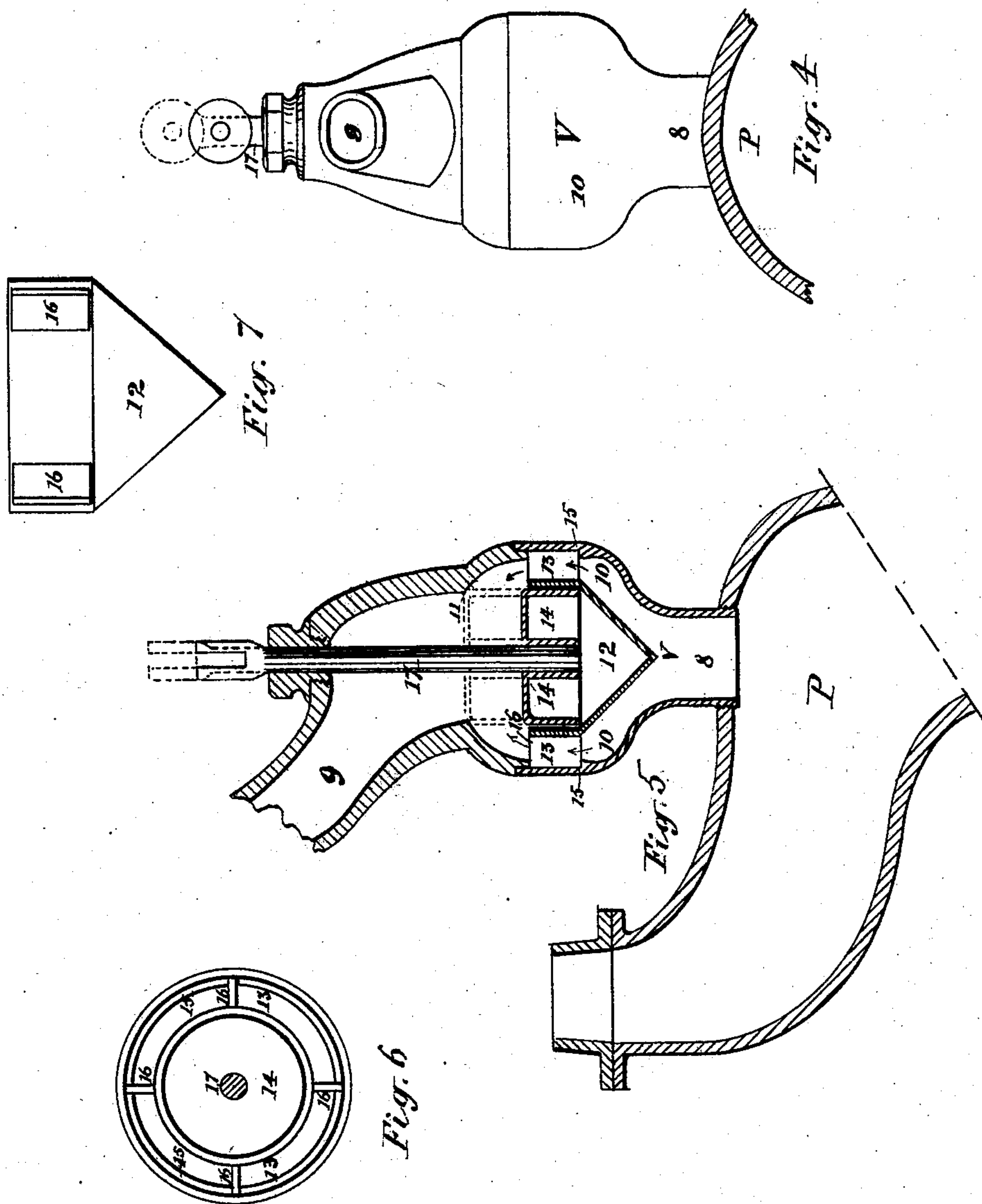


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# UNITED STATES PATENT OFFICE.

HENRY WATKEYS, OF SYRACUSE, NEW YORK.

## VARIABLE EXHAUST OF STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 260,433, dated July 4, 1882.

Application filed November 17, 1879.

*To all whom it may concern:*

Be it known that I, HENRY WATKEYS, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and  
5 useful Improvements in Variable Exhausts of Steam-Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

It is a generally-conceded fact that locomotives and other engines which obtain draft  
10 through the fire-box by throwing the exhaust-steam into the smoke-stack are subject to considerable waste of fuel, resulting chiefly from the sudden and violent intermittent blasts produced when first setting the engine in motion  
15 and the steam-valve is at full stroke.

Various expedients have been resorted to with the view of overcoming the aforesaid injurious effects; but in every instance, so far as  
20 has come to my knowledge, the capacity of the exhaust-pipe proper was made variable or adjustable by valves or interchangeable different-sized nozzles applied to the said exhaust-pipe. Experience, however, has proven that such arrangements, and, in fact, any obstruction, of  
25 whatever nature it may be, of the exhaust-pipe, will more or less choke the exhaust, notwithstanding extra outlets may be provided for the same. To obviate this injurious effect  
30 I provide the exhaust-pipe or exhaust-outlet with an extra or additional vent, to which I connect a valve whereby the same can be regulated and its escape-steam directed separately into the smoke-stack. By this arrangement  
35 the capacity of the ordinary outlet through the nozzle of the exhaust-pipe remains unimpaired and constant, the liability of back-pressure upon the cylinder is to a great extent obviated, and the volume and force of the exhaust-steam  
40 can be broken and to a great extent diverted from the main passage of the stack, so as to reduce the draft through the fire-box, all as hereinafter more fully explained.

In the accompanying drawings, Figure 1 is  
45 a side elevation of that portion of a locomotive to which my invention is applied, and is a view of that side usually occupied by the engineer. Fig. 2 is a view of the opposite side of said locomotive. Fig. 3 is an end view of the same. Fig. 4 is an enlarged exterior view  
50 of the valve which controls the auxiliary ex-

haust-valve. Fig. 5 is a vertical section of the same. Fig. 6 is a plan view of the lower section of said valve, and Fig. 7 is a side view of the valve-cage.

Similar letters of reference indicate corresponding parts.

P represents the exhaust-pipe of the engine, and V the valve connected to an extra or additional outlet in the said pipe. The valve V  
60 consists of a cage having the inlet 8 at its lower end, and the side outlet, 9, at or near its upper end, and the circumferential enlargement 10 about midway between them. The cage is divided horizontally at the said enlargement, and the upper section is provided  
65 on its joining-edge with a circumferential flange which projects part way down the inner side of the lower section. Between the lower-edge of said flange and a shoulder, 15,  
70 on the interior of the lower section are confined the wings 16, radiating from a cylindrical end of a hollow cone, 12, which has its apex toward the inlet 8 of the cage V.

In the cylindrical end of the cone 12 is fitted  
75 a cylindrical plug or valve, 14, to the center of which is attached a stem, 17, which is extended through the top of the cage V, and provided at the outside thereof with a suitable coupling device for the connection therewith of a lever,  
80 s, by which the valve 14 is operated.

By the described peculiar construction of the valve V the device is readily taken apart for cleaning or repairs, and the inverted cone 12, having the valve 14 entering its upper end,  
85 relieves the said valve of undue pressure from steam, and when the valve is made to retire into the cone automatically by the forward thrust of the reverse-lever, in the manner hereinafter described, the oil, which is usually introduced into the cylinder and its valve when  
90 the reverse-lever is in the aforesaid position, and ejected from the cylinder by the exhaust-steam, is prevented from coming in contact with the working part of the valve 14. Consequently the gumming of the same from the  
95 residue of such oil is to a great extent obviated. To the outlet 9 of the valve V is connected a pipe, 5, which is extended upward by the side of the usual draft-pipe, N, and into the  
100 stack D, thus separating the auxiliary exhaust from the main or ordinary exhaust and caus-



ing them to act independently of each other on the draft through the stack.

In order to obtain perfect and convenient control of the extra or auxiliary exhaust-outlet, I connect the lever or arm  $s$ , which lifts the valve of said outlet, to a rock shaft or rod,  $s'$ , arranged across the front end of the engine, and provide the extremities of said shaft with cranks or arms  $s^2$  and  $s^4$ , respectively. To the free end of the arm  $s^2$  is connected a rod,  $s^3$ , which is extended to the rear end of the engine and connected to a lever,  $t$ , on the side usually occupied by the fireman, thereby giving him control of the valve  $V$  and allowing him to regulate the exhaust according to the draft desired in the fire-box.

To the free end of the arm  $s^4$  of the rock-shaft  $s'$  is connected a rod,  $s^5$ , having at its opposite end a slot engaging a stud or pin on the side of the lift-arm  $u$ , which lifts the so-called "links" 25 and regulates the stroke of the steam-valve of the cylinder. The lift-arm  $u$  being connected with the reverse-lever  $w$  by a rod,  $v$ , and operated by the same, the aforesaid connection of the arm  $s^4$  with the lift-arm  $u$  affords to the engineer to a certain extent control of the extra exhaust-outlet. The slot in the end of the rod  $s^5$  is of such a length as to allow free play to the reverse-lever until it is thrown forward to give full stroke to the steam-valve of the cylinder. This motion of the reverse-lever brings the stud or pin on the lift-arm  $u$  in collision with the end of the slot in the bar  $s^5$ , and by that means forces the latter forward and causes the same to open the valve  $V$  of the extra exhaust-outlet by means of the arms  $s$  and  $s^4$ , connected with the rock-shaft  $s'$ . By this arrangement, with the reverse-lever the valve  $V$  is invariably opened when the valve of the cylinder is at full stroke and the cylinder receives and exhausts steam to its fullest capacity. When the engine is thus made to exert its power the exhaust requires ample vent to relieve the cylinders of back-pressure, and the force with which it issues through the ordinary outlet of the exhaust-pipe produces excessive draft through the fire-box, as aforesaid, whereby a large portion of the small particles of unconsumed fuel is carried through the flues of the boiler and thrown out of the top of the smoke-stack, thus not only frequently choking the flues by cinders lodging therein, but also causing a great waste of fuel. These effects are obviated to a great extent by my improved varia-

ble exhaust, which does not affect the capacity of the ordinary exhaust-outlet, but provides an additional vent for the exhaust, which is under the control of the engineer and his attendant. The engineer is compelled to open the said additional vent every time he throws the valve of the cylinder in full motion, and the fireman, by the lever on his side of the engine, can close it again, if desired, after the engineer has changed the action of the valve of the cylinder by the reverse-lever.

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

1. The exhaust-pipe  $P$ , having its vent unobstructed and unimpaired in capacity, and provided with an extra outlet and a valve connected to said outlet, as shown, in combination with the draft-pipe  $N$  and the stack  $D$ , substantially as and for the purpose specified.

2. In combination with the exhaust-pipe  $P$ , the valve  $V$ , consisting of a cage having the inlet 8 at one end, the exit 9 at the opposite end, and the enlargement 10, with valve-seat 11, intermediate, the inverted hollow cone 12, with its apex toward the inlet, and with passage 13 around it, and the plug 14, entering the cavity of the cone, substantially as described and shown.

3. The valve  $V$ , consisting of a cage having the inlet 8 at one end, the outlet 9 at the opposite end, and the enlargement 10 intermediate, and divided transversely at the latter, the ingress-section provided with the shoulder 15, the egress-section having valve-seat 11, and the valve 14, fitted to the interior of a cylinder on the end of the cone 12, and provided with the rod 17, all constructed and combined substantially as described and shown.

4. In combination with the exhaust-pipe  $P$ , the valve  $V$ , arm  $s$ , shaft  $s'$ , arm  $s^2$ , rod  $s^3$ , lever  $t$ , and the arm  $s^4$ , rod  $s^5$ , lift-arm  $u$ , rod  $v$ , and the reverse-lever  $w$ , substantially in the manner described and shown, for the purpose specified.

In testimony whereof I have hereunto signed my name and affixed my seal in the presence of two attesting witnesses, at Syracuse, in the county of Onondaga and State of New York, this 13th day of October, 1879.

HENRY WATKEYS. [L. S.]

Witnesses:

E. LAASS,  
CHAS. GARLICK.