2 Sheets. Sheet 1.

J. H. Mills,

Compound Steam Engine.

No. 62,556. Patented Mar. 5, 1867.

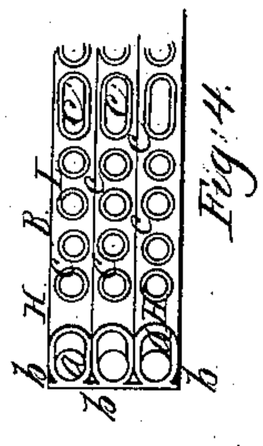

Fig. 4.

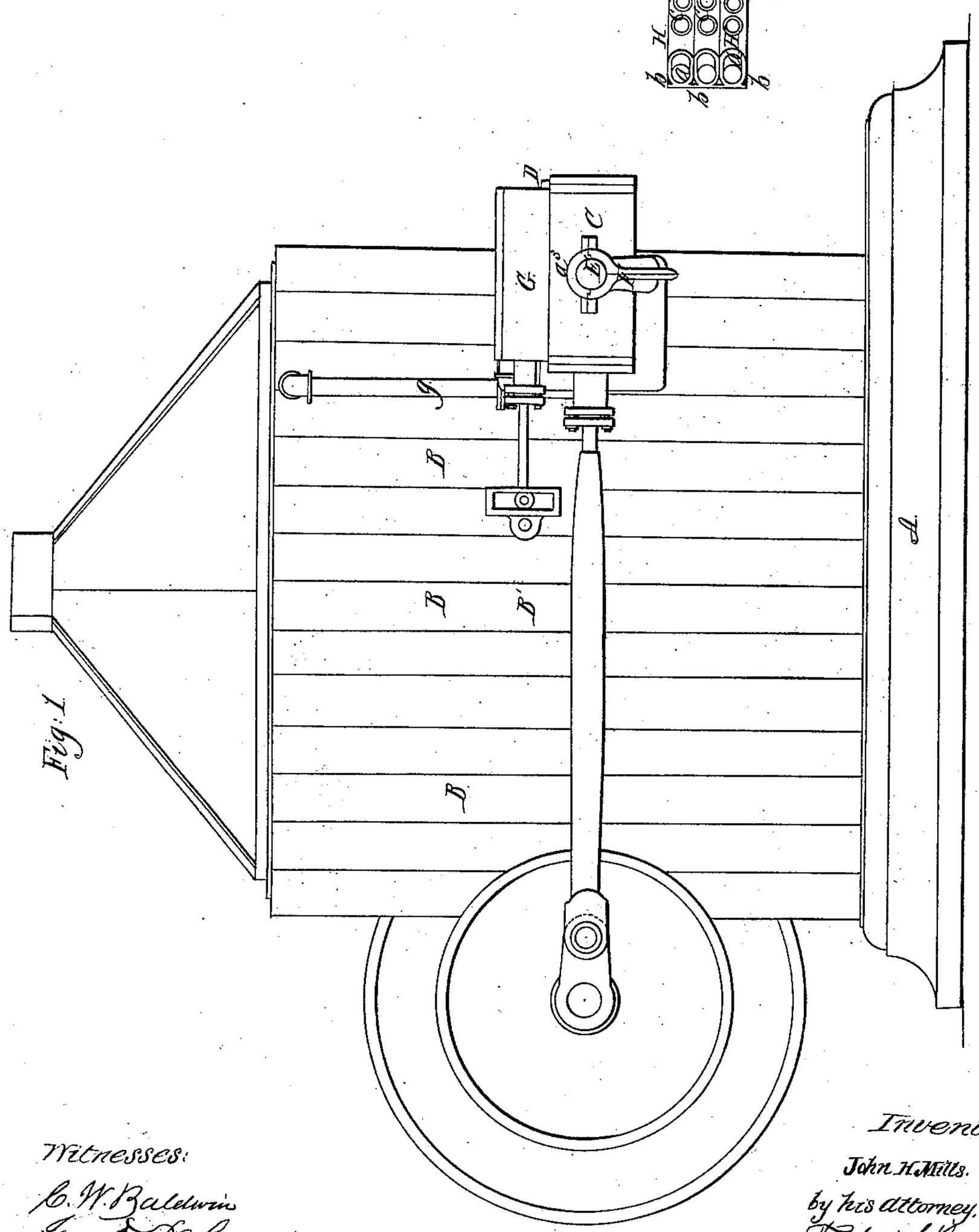

Fig. 1.

Witnesses:
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Jared D. Sumner

Inventor:
John H. Mills.
by his attorney.
Frederick Curtis

2 Sheets-Sheet 2.

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Fig. 1.

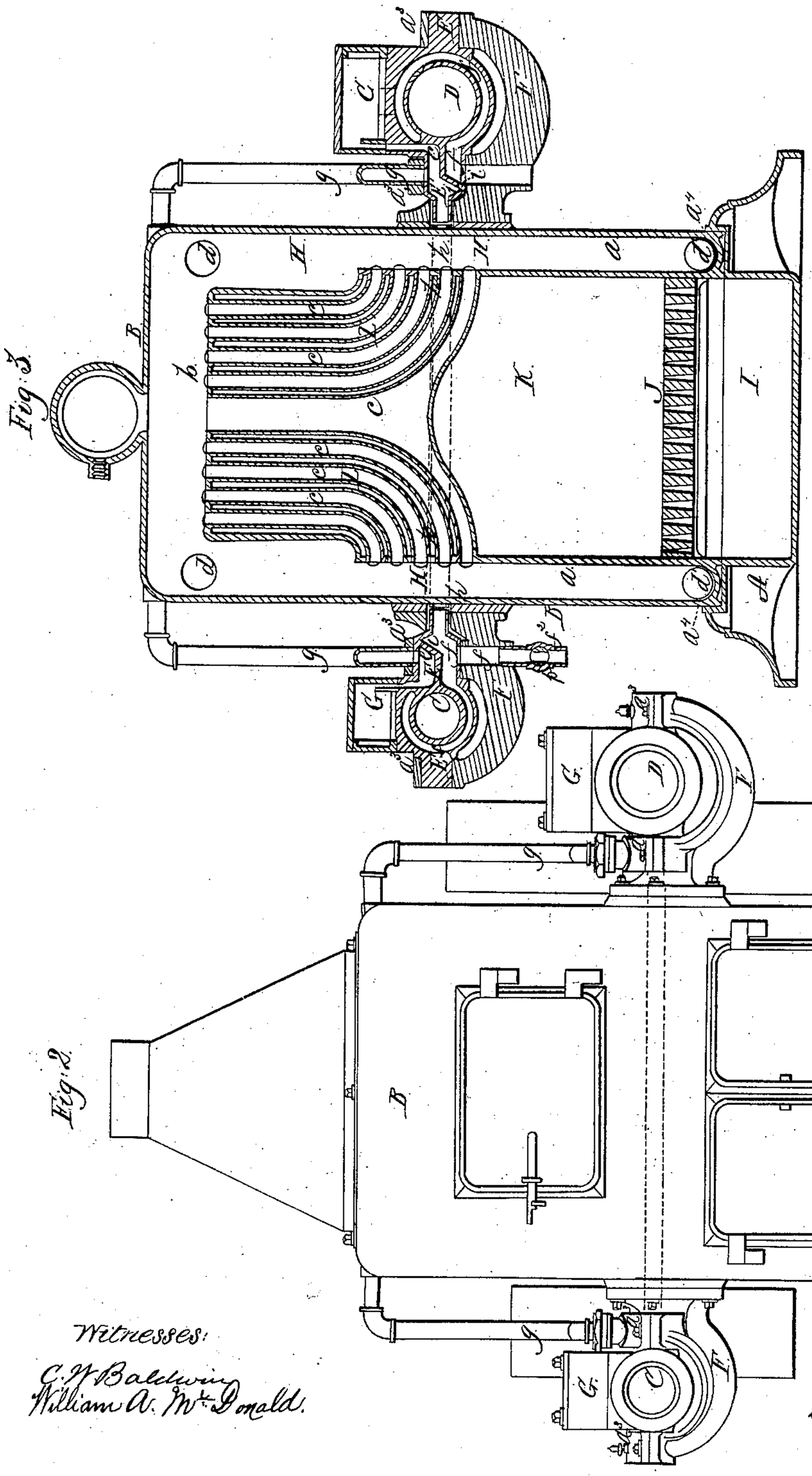

Fig. 2.

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Inventor:
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by his attorney
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United States Patent Office.

JOHN H. MILLS, OF BOSTON, MASSACHUSETTS.

Letters Patent No. 62,556, *dated March* 5, 1867.

IMPROVEMENT IN STEAM ENGINE.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Be it known that I, JOHN H. MILLS, of Boston, in the county of Suffolk, and State of Massachusetts, have invented certain new and useful improvements in portable Steam Engines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, and in which—

Figure 1 is a side view; and

Figure 2 is a front end view; and

Figure 3 is a vertical and transverse section of a portable steam engine, constructed in accordance with my invention.

Figure 4 is a horizontal section of one of the sectional boilers, to be hereinafter described.

The object of this invention is to produce a portable steam engine, simple, compact, and cheap in its construction, efficient in its operation, and one which can be separated and packed in parts for convenience of transportation.

My invention consists in constructing a portable engine having two oscillating cylinders of different capacities, the exhaust steam from the smaller cylinder being carried by a connecting pipe into the larger, in which it is used expansively. The invention also consists in the application to or combination with portable engines of a series of sectional cast-iron boilers, in such manner as to increase or diminish at pleasure the amount of steam-converting surface of the combined boilers, as well as to enable the whole engine to be packed in separate portions for transportation in localities where large bodies cannot be conveniently carried. The invention further consists in carrying the connecting pipe of the two cylinders over the fire, or through the fire-chamber of the same, in order to superheat the exhaust steam passing from the smaller cylinder, as well as to vaporize and utilize the condense water, which would otherwise be carried away in the final exhaust from the larger cylinder. By this means the pressure of steam between the two cylinders is considerably increased, and the consumption of fuel economized. The invention further consists in the peculiar construction or arrangement of the steam-communicating passages of the steam chests and cylinders, and their connection with the trunnions of the said cylinders, in manner and for the purpose as hereinafter referred to and described.

By referring to the above-mentioned drawings, as constituting part of this specification, it will be seen that the bed-piece or foundation of the engine is shown at A as recessed or rebated, as shown at a^4, for the reception and support of a series of cast-iron sectional boilers or generators, B B, etc., properly bolted together, the bed being of sufficient size to contain any number of these sectional boilers which the engine will ever require; the number of them or their combined capacity, as shown at B′ in the accompanying drawings, being the amount which the engine, as therein exhibited, will probably require, the connections of the cylinders and the working shafts being accommodated to this number. Should more be required, however, they may be added in any number desired without removing or changing these connections. The smaller cylinder is shown at C, and the larger at D, they both being constructed with horizontal trunnions E E′, supported in boxes, a^3 a^3, formed upon brackets, F F, securely bolted to opposite sides of the combined boiler B′, and so that the cylinders shall oscillate freely upon the said trunnions, the outer one, E, of which is solid or homogeneous with the cylinder, while the inner one, E′, is hollow, or formed with steam passages, as hereinafter described. The steam chest G surmounts the cylinder in the usual manner, its valve or valves being operated in any manner well known to mechanics.

By referring to fig. 3 of the drawings it will be seen that the sectional boilers B are composed of a closed steam and water pipe or reservoir, H, made in the form of a right-angular yoke, with its side branches, *a a*, resting within the rebate a^4 of the bed A of the engine, which also has a central space, I, formed in it to serve as an ash-pit. Extending across between the lower parts of the branches *a a* of the generator H is a grate, J, for supporting the fuel of the fire-pot K. The outer surface of the pipe H is formed with offsets or lips, *b b*, for the purpose of making a tight joint with the next adjacent boiler, and also to form a hot-air chamber, L, within the yoke of the said pipe. The side portion *a a* of this pipe H communicates with the top horizontal portion *b′* by means of curved or bent pipes *c c c*, etc., the central one, *c′*, of which being of larger area than the others, and coming in direct contact with the heat of the fire in the fire-pot K. The pipes H H, etc., communicate

with each other by means of ports or pipes *d d d' d'*, the upper ones, *d d*, being steam-communicating ports, and the lower ones, *d' d'*, being water-communicating passages. By the peculiar construction and arrangement of the pipe H, in connection with the pipes *c c c*, etc., the water has a free circulation from the lower part of the boiler upwards, the large central pipe or space enabling the water to pass directly up the centre, and then outwardly and down through the side branches *a a* of the pipe H, a portion of it falling to the bottom thereof, and a portion again raising through the pipes *c c c*. The trunnion E', before referred to as being hollow, has two passages, *e f*, formed within it, the steam from the boilers being conducted by means of a pipe *g*, (leading through the box a^3 supporting the trunnion,) into the passage *e*, from whence it passes through the steam chest G into the cylinder, and after having performed its office therein, escapes through the usual port and exhausts into the passage *f* of the trunnion, from whence it enters the connecting pipe *h*, connecting the trunnion E' of the cylinder C with that of the cylinder D, it being understood that communication between the two passages *e* and *f* is cut off, or as shown by the partition *e* in fig. 3 of the drawings. By this arrangement of steam passages in the trunnion, I am enabled to employ one trunnion only for this purpose, leaving the opposite trunnion solid, thus rendering it much stronger, and not liable to heat. Furthermore, a vertical passage, f^1, is made in the trunnion E' leading downward through the bracket F, and is supplied with a stop-cock, f^2, as represented. When exhausting from the cylinder C to the cylinder D this cock should be closed. When the cylinder C is used alone, and the cock of the connecting pipe shut, the above-mentioned cock f^2 is to be opened, which will allow the exhaust from the cylinder to pass into the atmosphere through the passage f^1. The joint connecting the communicating pipe *h* with the trunnion should be properly packed, to prevent leakage, and the pipe is to be carried through the air-heating chamber L and between the series of steam pipes *c c c* of each boiler, B B. By this means the steam within the said pipe *h* is superheated to an extent to greatly increase its pressure, the gain increasing in proportion to the pressure of the steam as it leaves the first cylinder. Another advantage gained by the passing the pipe through the fire-chamber, in addition to utilizing the surplus heat of the fire, is the fact before mentioned, that any condense water within it will be vaporized or converted into steam, thus materially increasing its volume, and consequently lessening the amount of fuel required to run the engine. It will be understood that the steam enters and leaves the cylinder D and its trunnion E' in the same manner as in the cylinder C. As each cylinder is supplied with steam directly from the boiler by an independent pipe, and the connecting pipe *h* being provided with a stop-cock at any convenient point between the two cylinders, it will be evident that either cylinder may be used independently, and thus form an engine in itself; or, when great power is required, the two may be used together, with the steam leading directly into them, by which means much more power will be obtained from the two than when exhausting from one to another.

I am aware that the principle of exhausting steam from one cylinder to another of a steam engine is not new and forms no part of my invention, and consequently I lay no claim broadly to this principle.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is as follows:

1. The combination, with a series of sectional boilers, of the steam cylinders under the arrangement herein described, so that either cylinder alone, or both together, may be used with the full power of steam generated by the said boilers, or so that the smaller cylinder shall exhaust into the larger, substantially as set forth.

2. The pipe for connecting the two cylinders, arranged so as to pass through the combustion-chamber or fire-pot of the boilers, substantially as shown and specified.

3. The arrangement of the boiler B, consisting of the bent pipe H and connecting pipes *c*, operating together as shown and described.

4. The arrangement of the inner trunnions of the steam cylinders in such manner that the steam may pass directly from one cylinder to the other through the said trunnions, as and for the purposes set forth.

JOHN H. MILLS.

Witnesses:

C. W. BALDWIN,

FREDERICK CURTIS.