

(No Model.)

2 Sheets—Sheet 1.

B. C. VANDUZEN.
ENGINE.

No. 265,473.

Patented Oct. 3, 1882.

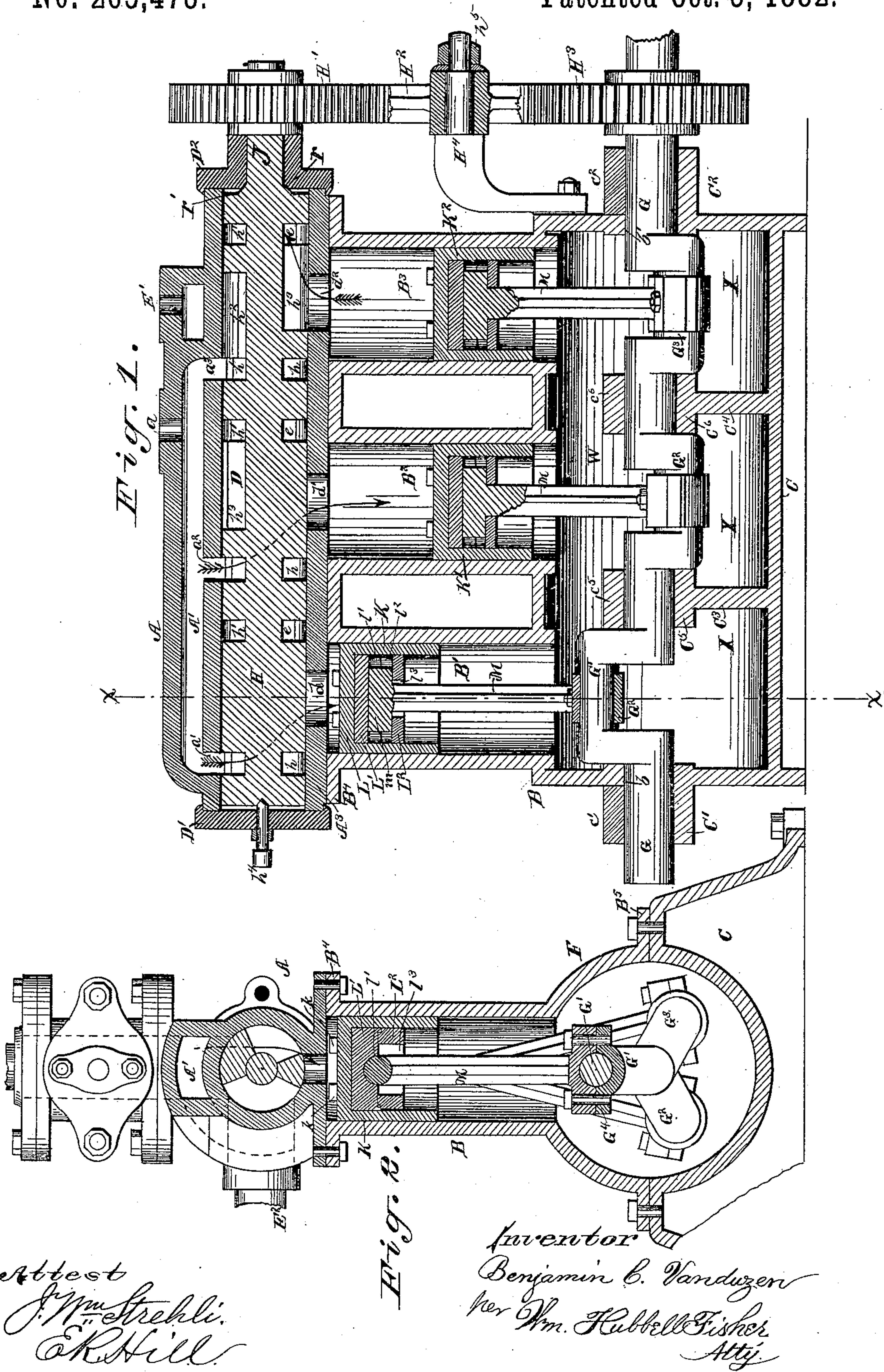


Fig. 2.

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Fig. 3.

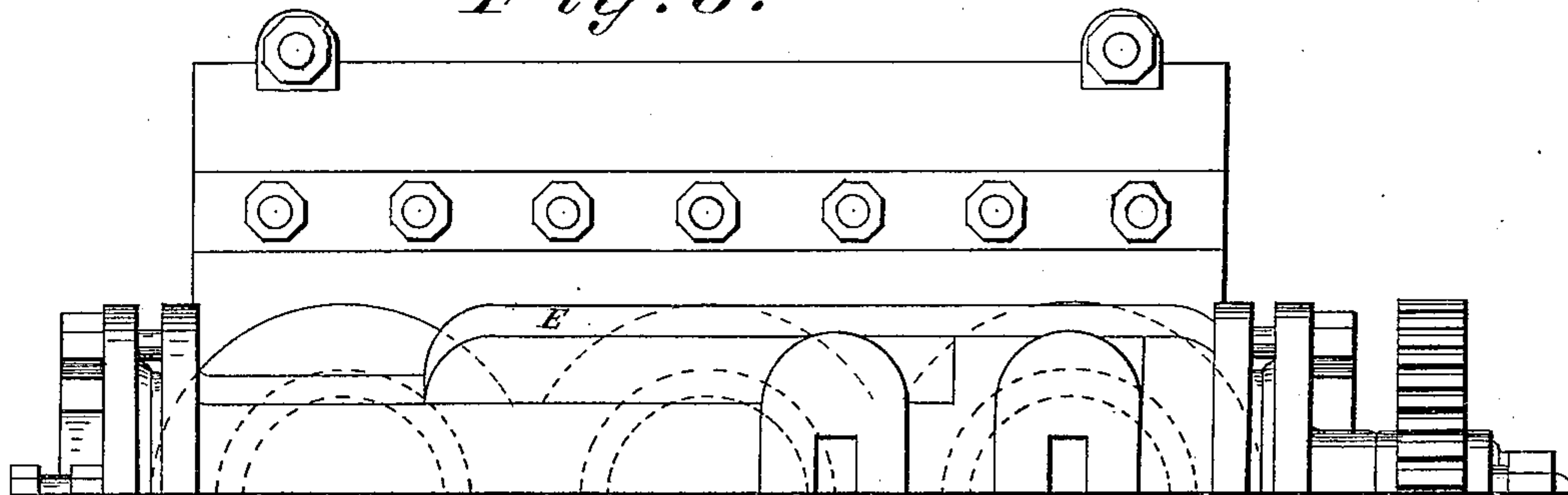


Fig. 4.

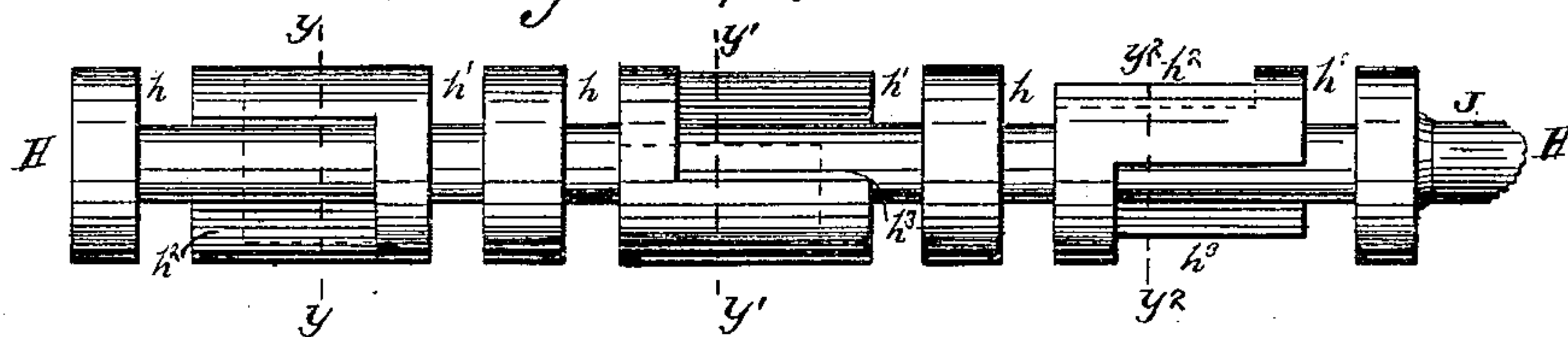
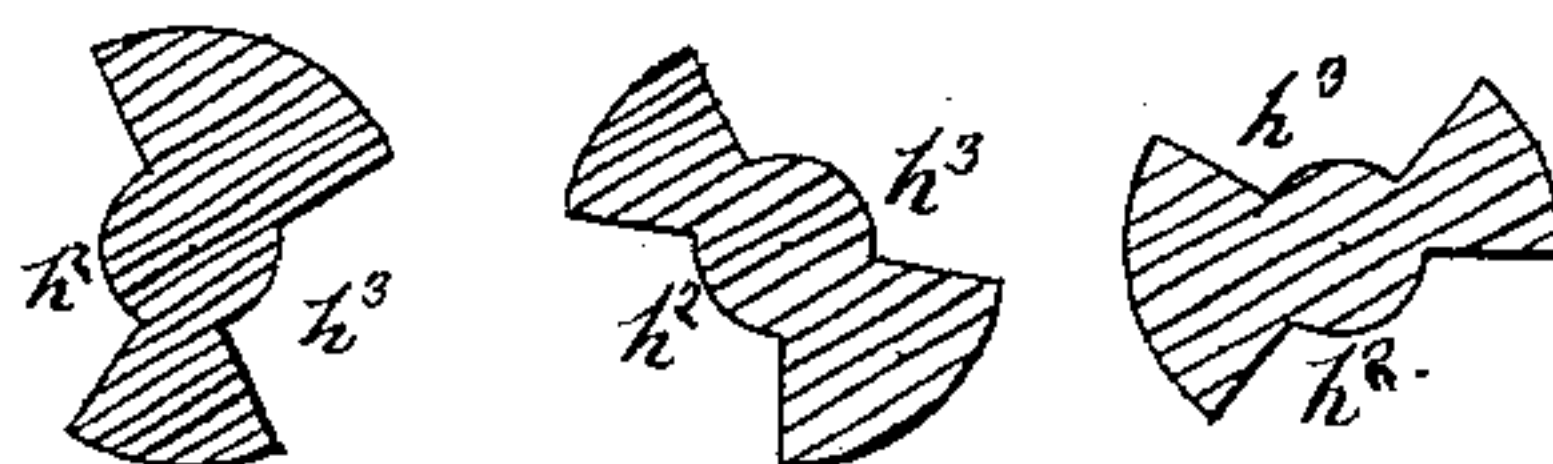


Fig. 5



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UNITED STATES PATENT OFFICE.

BENJAMIN C. VANDUZEN, OF CINCINNATI, OHIO.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 265,473, dated October 3, 1882.

Application filed January 16, 1882. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN C. VANDUZEN, of the city of Cincinnati, in Hamilton county, and State of Ohio, have invented certain new and useful Improvements in Engines, of which the following is a specification.

My invention relates to that class of engines known as "three-cylinder engines;" and it consists in certain novel and peculiar arrangements of the component parts, whereby greater speed is obtained with a minimum of cost, the engine being also so constructed as to obtain a maximum strength with a minimum of material and greater efficiency and more reliable action in the working parts thereof.

In the accompanying drawings, forming part of this specification, Figure 1 is a longitudinal section. Fig. 2 is a cross-section taken on the line X X of Fig. 1. Fig. 3 is a plan of half of the top. Fig. 4 is a longitudinal elevation of the steam or slide valve, shown in the same position as in Figs. 1 and 2. Fig. 5 shows cross-sections of the steam-valve, taken respectively on the dotted lines Y Y, Y' Y', Y² Y², shown in Fig. 4.

The frame of the engine is composed of three castings, A B C, which are firmly bolted together in the order named, and which form principally the necessary supports and inclosures for the various working parts.

The casting A, together with its necessary connections, forms the steam-chest. The steam-passage A' has its inlet at *a* and three inner openings, *a'* *a*² *a*³, leading to the steam-valve chamber D, which has openings *d* *d'* *d*² on its under side, connecting respectively with the steam-cylinders B', B², and B³. The exhaust-passage E is situated on the rear side of the casting A, which is slightly enlarged to permit of said passage having sufficient capacity. This passage E is preferably constructed with two exhaust-outlets—viz., E' (shown in Fig. 1) and E² (shown in Fig. 2)—when the engine is to be used with certain kinds of reversing-valves, one of which kinds is of a peculiar construction, and which, being invented by me, I propose to protect by Letters Patent. When various other reversing valves or devices are to be employed with said engine or all reversing devices are dispensed

with only one exhaust-port need be constructed in or employed with this engine.

The casting B consists of the separated steam-cylinders B' B² B³, and also forms the upper half of the casing around the crank-shaft G. It has a flange, B⁴, around its top, by which it is bolted to part A³ of the casting A, and another flange, B⁵, around the base, by which it is bolted to the top of the casting C. From a point a little above the bottom line of the steam-cylinders the casting B becomes of a continuous half-cylindrical shape, with closed ends, and of a sufficient size to permit of the easy working of the operating parts inclosed. This casting having had its upper and lower faces accurately finished, so that they lie in parallel planes, it is then set upright on the bed-plate of a suitable boring-machine and the cylinders turned out, thus insuring the axis of the same to be parallel to each other and at right angles to the plane of the bottom and top faces. The lower part of this casting B is cut out sufficiently at *b b'* to fit the upper half of the crank-shaft G.

The casting C has also closed ends, and is made with flaring sides and of a sufficient width on the bottom to form a substantial and solid base for the whole engine. It may be bolted or fastened to the floor in any preferred manner. The upper portion of the casting is of a semi-cylindrical shape, and is accurately fitted to the lower portion of the casting B, forming the lower half of the cylindrical casing F, which incloses the crank-shaft G. This casting C also has at each end the semi-cylindrical projections C' C², and also in the interior, equidistant from each other and the sides of the casting, the standards C³ and C⁴, which are enlarged at their tops C⁵ and C⁶, so as to be of a shape and height similar to the projections C' and C², and forming, together with the same, the under supports of the crank-shaft. The tops *c'*, *c*⁵, *c*⁶, and *c*² are bolted to their corresponding under supports, C', C⁵, C⁶, and C², forming with the same the journal-boxes for the crank-shaft.

The steam-valve H consists of a shaft or cylinder, having the annular grooves *h h h* and *h' h'* cut into its periphery, the grooves *h h h* being directly opposite to and in the same ver-

tical plane as the inlets a' a^2 a^3 , the grooves h' h' h' being at the opposite sides of the cylinders and communicating with the exhaust-passage E through corresponding openings, e e e . (See Fig. 1.) There is also cut out of the periphery of the valve a number of oblong radial chambers, h^2 h^2 h^2 , communicating with the grooves h h h , and a corresponding number, h^3 h^3 h^3 , communicating with the grooves h' h' h' . The valve H is held at one end by the pointed set-screw h^4 , passing through the cap D', and at the other end it is somewhat reduced in diameter to form the neck J, which is journaled in the cap D², and projects outwardly beyond the same far enough to permit of the fastening of the spur-wheel H' to it. The cap D² is beveled at r , Fig. 1, and the correspondingly-beveled edge r' of the valve H works against the beveled face r . This is a ground-joint and perfectly steam-tight. As the working-faces wear the slack is taken up by the screw or center h^4 . This wheel H' meshes into the wheel H², which in turn meshes into the wheel H³, attached to and concentric with the crank-shaft G. The bracket H⁴ is securely bolted to the end of the casting B, (being of the general shape shown in Fig. 1,) and has its outer end so shaped as to pass through and accurately fit the hub of the wheel H², which is intended to run loosely upon the same, the wheel being prevented from slipping off by the nut h^5 .

The crank-shaft G is journaled, as has been heretofore described, and is constructed with three cranks or eccentric cranks, G' G² G³, corresponding to and placed "in line" with the centers of the cylinders, B' B² B³, respectively, and having such relative positions that their axes are one hundred and twenty degrees or one-third of a revolution apart. Each of the piston-heads K K' K² consists of an inverted hollow cylindrical cap, L, to the interior of which is bolted the plates L' L². The upper plate, L', has a semicircular groove, l' , cut in its under side parallel to the line of the crank-shaft G and the lower plate, L², a corresponding groove, l^2 , cut in its upper side, and has also an opening, l^3 , cut at right angles to the line of the crank-shaft.

The pitmen M M M each have a cylindrical head, m , parallel to the line of the crank-shaft, and by which they are respectively connected to the piston-heads K K' K². The cylindrical heads m fit snugly into the cylindrical groove l^2 in the plate L², the plate being brought up snugly against the plate L', and the latter in turn against the under side of the cap L by the bolts or screws k k . The opening l^3 is of sufficient size to allow sufficient clearance for the working of the pitman, and while the pitman is suspended and swings freely from the lower plate L² all backward motion or shifting is effectually prevented by the plate L'. Each pitman is enlarged sufficiently at its lower ends to permit of semicircular grooves, which are present in the under side thereof of sufficient

size to fit the crank-shaft G, to which the pitman is fastened by means of the caps G⁴, bolted to the under face of said lower ends.

To render the engine capable of being reversed at will, any suitable reversing device is to be attached to the engine and employed therewith.

In describing the operation of the engine, let it be supposed that no reversing-valve is used, and that the engine is to run in only one direction. Either the exhaust-port E' or the exhaust-port E² is to be closed or dispensed with, and the engine will exhaust through that one of the said exhaust-ports E' E² which is still retained. As shown in the drawings, the cylinder B² is receiving the steam through the inlet a^2 , corresponding groove h , chamber h^2 , and opening d , the piston-head K' being shown as having traveled two-thirds of the downward stroke. The cylinder B³ is exhausting steam through the opening d^2 , corresponding chamber h^3 , groove h' , and passage e into the exhaust-chamber E, the piston K² having started one-third on its upward stroke. The cylinder B is just beginning to receive the steam through the inlet a' and corresponding groove h , chamber h^2 , and opening d . By the time that the piston K will have reached a similar position to the one now occupied by the piston K' the piston K² will have reached the end of the upward stroke and its cylinder will be receiving steam for the return downward stroke. The piston K' will then have assumed a similar position to that now occupied by piston K², and so the operation will be repeated indefinitely. The valve H, however, is so set that it opens the steam-passage to each cylinder a short time before the corresponding piston reaches the end of the upward stroke, thus forming a cushion of live steam to resist any jar or strain caused by the rapid ascension of the piston.

While the position of my engine is preferably vertical, as shown, nevertheless it may occupy any other desired position—as, for example, the cylinders may be horizontal; but the most desirable positions for securing a most perfect balance of all parts are the ones shown in the drawings, and the one which is the exact reverse of this—viz., where the valve is underneath and the crank-shaft G on top, the longitudinal planes of the cylinders being vertical.

The lower chamber, X, may, when desired, be divided into as many chambers as there are cranks, one chamber for each crank. This chamber and its piece C may also be dispensed with and the crank-shaft and the piece be otherwise suitably supported in any suitable manner.

The number of gear-wheels, as H' H² H³, may be diminished to two or increased to any practical number desired, regard being had to their respective diameters and to the number of their teeth.

While all of the various features of my invention are preferably employed together, one or more of them may be used separately, and,

when desired, in conjunction with suitable mechanism and devices other than herein shown, and will then still fall within the scope of my invention.

5 What I claim as new and of my invention, and desire to secure by Letters Patent, is—

1. The rotary valve provided with annular chambers h , each having a chamber or recess, h^2 , in the side of the valve, and the annular
10 chambers h' , each having a recess or chamber, h^3 , in the side of the valve, in combination with the steam-chest having the ports $a' a^2 a^3$ and ports $d d' d^2$, and the port e , substantially as and for the purposes specified.

15 2. The combination of the piston-head L and piece L' and the piece L^2 , provided with openings l^3 and the pitman M .

3. The combination of the piston-head L and piece L' and the piece L^2 , provided with open-
20 ings l^3 and the pitman-head m , substantially as and for the purposes specified.

4. The rotary valve provided with the annular chambers h , each having a chamber or recess; h^2 , in the side of the valve, annular cham-
25 bers h' , each having a recess or chamber, h^3 , in the side of the valve, substantially as and for the purposes specified.

5. The rotary valve constructed substan-
30 tially as specified, in combination with ports, as $a' a^2 a^3$, and ports, as e , substantially as and for the purposes specified.

6. The rotary valve provided with annular chambers h , each having a chamber or recess, h^2 , in the side of the valve, annular chambers
35 h' , each having a recess or chamber, h^3 , in the side of the valve and located in close proximity to the cylinders, in combination with the valve-chest placed upon the ends of the cylin-

ders and forming the heads thereof, and the short ports, as $d d' d^2$, substantially as and for 40 the purposes specified.

7. The rotary valve provided with annular chambers h , each having a chamber or recess, h^2 , in the side of the valve, annular chambers h' , each having a recess or chamber, h^3 , in the
45 side of the valve and located in close proximity to the cylinders, in combination with the valve-chest placed upon the ends of the cylinders and forming the heads thereof, and the ports, as $a' a^2 a^3$, and ports, as e , the short
50 ports, as $d d' d^2$, substantially as and for the purposes specified.

8. The rotary valve provided with annular port h , having chamber h^2 , and annular port h' , having chamber h^3 , and further provided with
55 neck J , provided with the beveled face r , in combination with the steam-chest having ports, as described, and the beveled face r' , and the center h^4 , substantially as and for the
60 purposes specified.

9. The rotary valve provided with annular port h , having chamber h^2 , and annular port h' , having chamber h^3 , and the neck J , substan-
tially as and for the purposes specified.

10. In combination with the rotary valve 65 provided with annular ports and chambers, substantially as described, the valve-chest provided with extended port A' , having openings, as $a' a^2 a^3$, and ports, as $d d' d^2$, and port a , and exhaust-port e , connected to one main exhaust, 70 as E' or E^2 , substantially as and for the purposes specified.

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