No. 654,966. Patented July 31, 1900.

F. G. GASCHE & F. H. FOOTE.

COMPOUND BLOWING ENGINE.

(Application filed Feb. 26, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

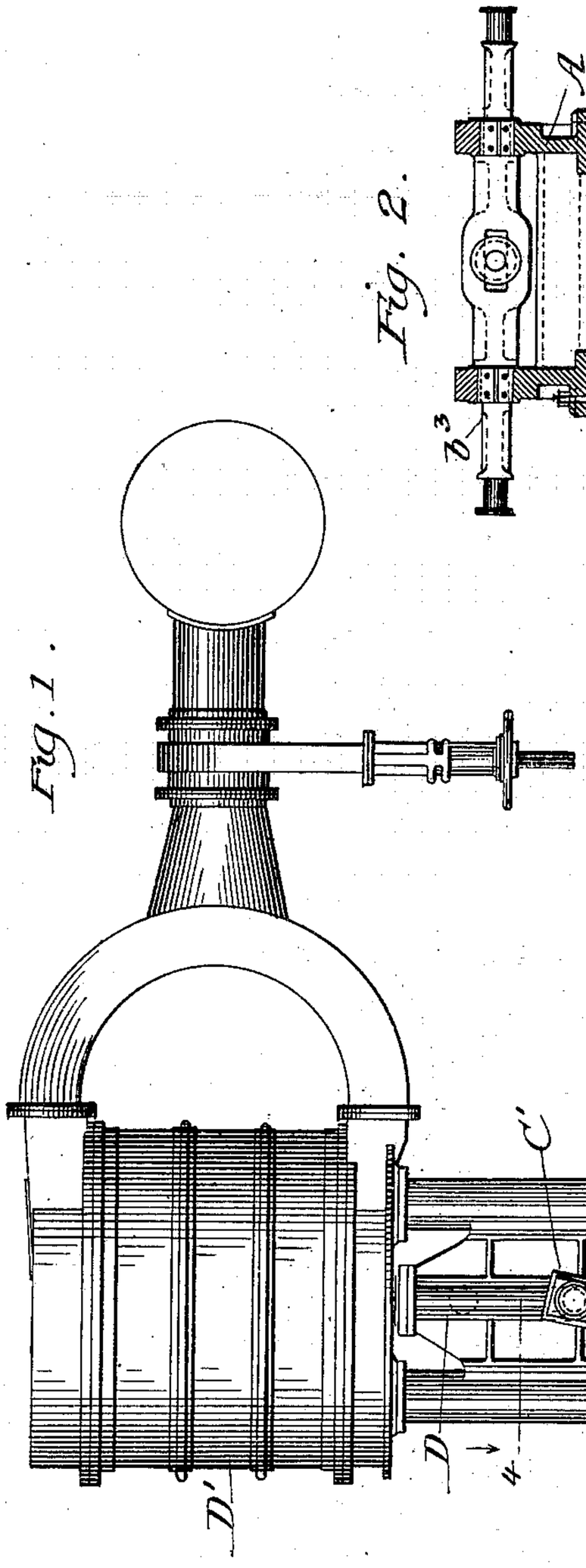

Fig. 2.

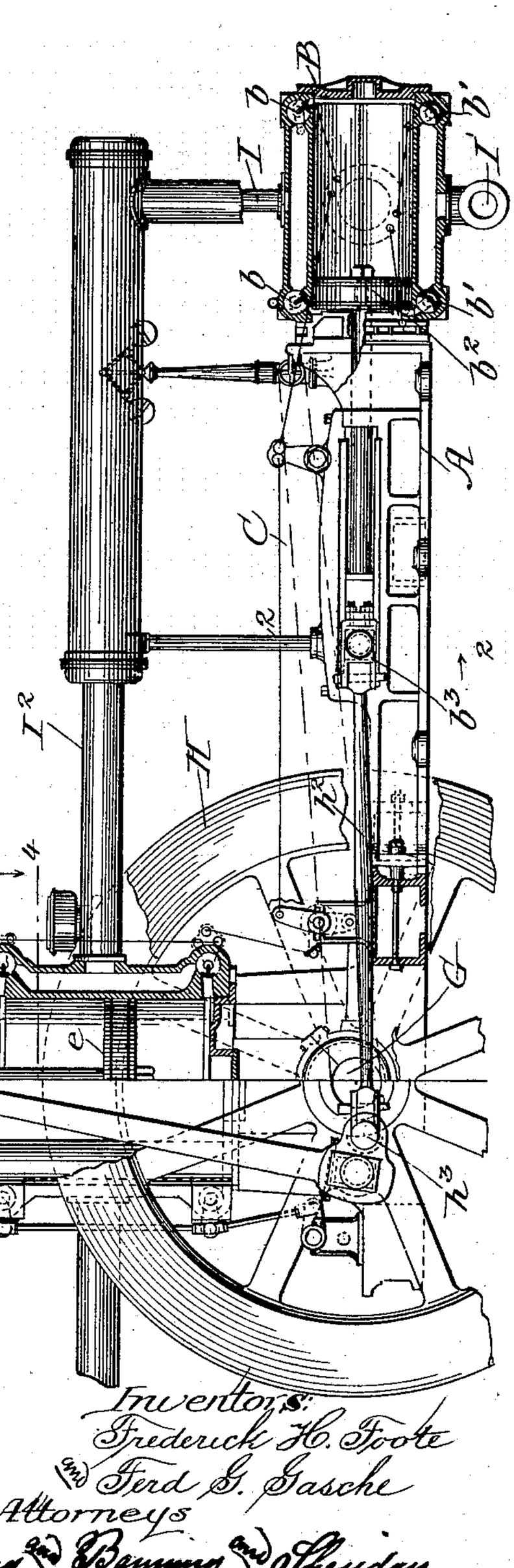

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Fig. 3.

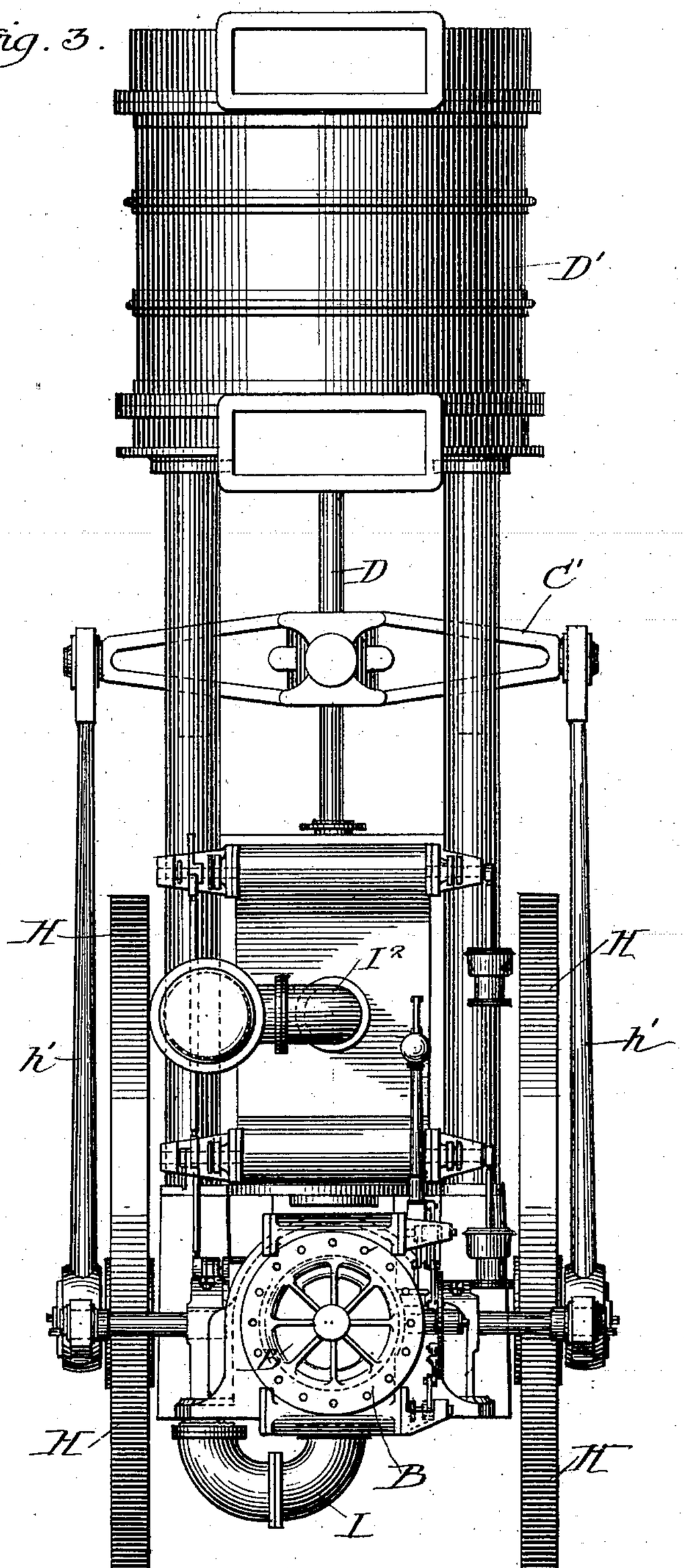

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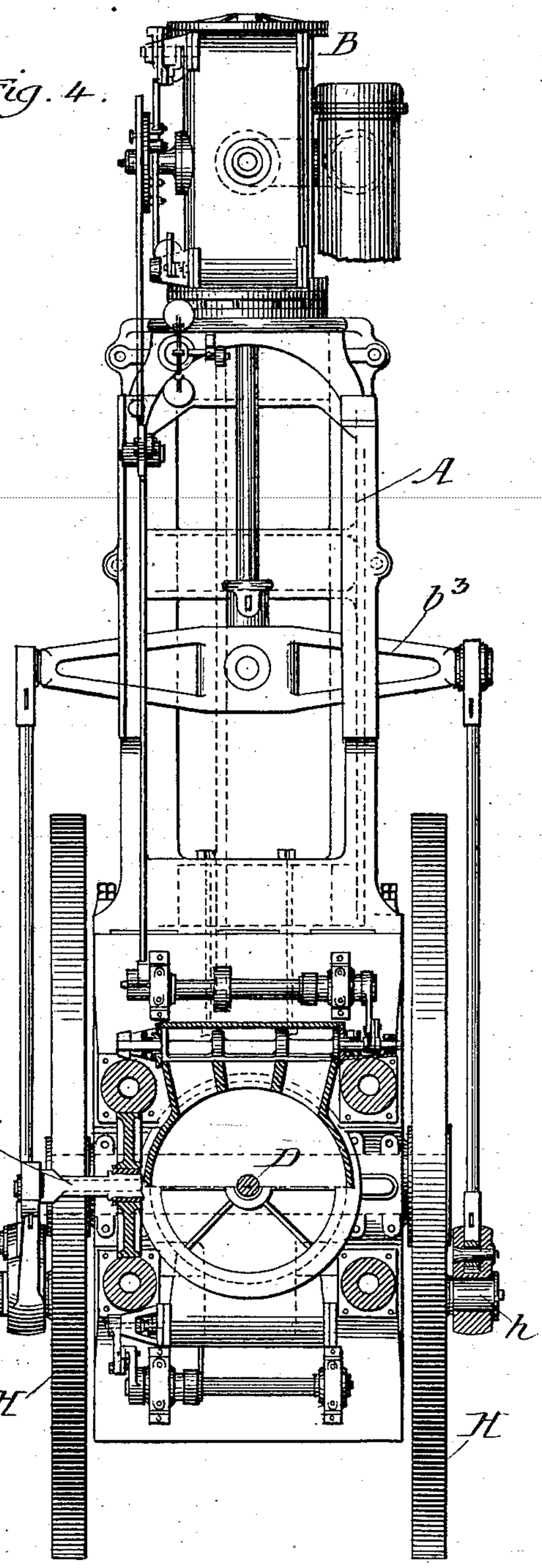
Fig. 4.



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UNITED STATES PATENT OFFICE.

FERD G. GASCHE AND FREDERICK H. FOOTE, OF CHICAGO, ILLINOIS.

COMPOUND BLOWING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 654,966, dated July 31, 1900.

Application filed February 26, 1898. Serial No. 671,736. (No model.)

To all whom it may concern:

Be it known that we, FERD G. GASCHE and FREDERICK H. FOOTE, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Compound Blowing-Engines, of which the following is a specification.

Our invention relates to that class of engines in which a reciprocating piston is used for compressing atmospheric air and which is connected directly with the movable pistons of a compound engine.

The object of our invention is to provide a simple, economical, and efficient compound engine; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side elevation, partly in section, of a blowing-engine constructed in accordance with our improvements; Fig. 2, a sectional detail taken on line 2 of Fig. 1; Fig. 3, an end elevation looking at the engine from the right-hand of Fig. 1; and Fig. 4, a plan view, partly in section, looking at the mechanism from the top and taken on the irregular line 4 4 of Fig. 1.

In the art to which this invention relates it is well known that it is common to use a blowing-engine and connect the same directly with the pistons of a compound engine arranged in tandem relation with it. The objections to this arrangement and construction are twofold—first, the engine occupies considerable space, and, second, the maximum efficiency of the compound engine is not obtained, for the reason that the maximum power is applied to the compressing mechanism at a time when it has the least work to do. The principal object of our invention, therefore, is to overcome these objections by providing an engine in which the high-pressure and low-pressure cylinders are arranged in right-angular relation to each other and connected to a common crank-shaft, so as to perform the work economically and efficiently.

Further objects will appear from an inspection of the drawings and the following description and claims.

In describing the engine shown in the accompanying drawings we will only describe those portions which we consider to be new in connection with so much as is old as will enable those skilled in the art to practice the invention, leaving out of consideration old and well-known mechanisms for the purpose of avoiding prolixity, confusion, and ambiguity.

In constructing an engine in accordance with our improvements we make a frame A of the desired size, shape, and strength to hold the operative and other parts in proper relation with each other. On one end of this frame and preferably arranged in a horizontal plane is a high-pressure cylinder B, which is provided with inlet and exhaust valves b b' of the usual type and which are arranged to be operated by what is known as the "Corliss" valve-gear, shown in diagrammatic view, all of which is well known and understood in the art.

In order to provide for the economical operation of the compressing-piston and its rod D, which is arranged in the compressing-cylinder D', we provide a low-pressure cylinder E and arrange it vertically on the frame portion substantially at right angles to and above the plane occupied by the companion cylinder. Each of the cylinders is provided with movable pistons b^2 and e, having projecting piston-rods which are connected to cross-heads b^3 and c'. The crank-shaft G is arranged at a point where lines carried centrally or axially through the piston-rods of the high-pressure and low-pressure cylinders would meet. This crank-shaft is provided with fly-wheels H, which practically form the cranks which carry the wrist-pins h, to which the connecting-rods h', which connect with the piston of the low-pressure cylinder, are connected, so as to transform the rectilinear movements of the low-pressurse piston into rotary movements of the crank-shaft. In order to assist in the rotations of the crank-shaft in the operation of the compressing-piston, connecting-rods h^2, which connect with the cross-head of one piston, are pivotally secured to the strap of the connecting-rod on the other piston at h^3 at a point off center to the wrist-pin, so that during the rotations of the wrist-pin the connecting-rods travel in the same plane, and the end of the vertical connecting-rod describes a true circle, while that

of the high-pressure connecting-rod describes, approximately, an ellipse. This arrangement and construction of parts obtains a material advantage in that when the compressing-piston is at the beginning of its stroke, so that the air in one side is compressed to its maximum density, the horizontal piston is exerting its maximum effect—that is, pulling the crank under—and when the work of compressing begins the other side of the piston of the vertical cylinder is beginning at its point of least efficiency until the quarter is reached, where the air begins to be compressed to its greatest density. Then the vertical piston exerts its maximum effect. A further advantage is that the pivoting of the two connecting-rods to a single wrist-pin in the manner described, and shown in the drawings, enables the work to be done at a point close to the journal of the crank-shaft and prevents a twisting or rocking motion of the shaft, with consequent injurious crank-pin pressures.

Steam under pressure is admitted into the high-pressure cylinder directly through the inlet-pipe I and exhausted from such cylinder through the pipe I′ into the low-pressure cylinder by means of the pipe I^2. The arrangement of the engines in the right-angular manner instead of a tandem manner permits of a direct communication from the high-pressure cylinder to the low-pressure cylinder so that the fluid under pressure may be admitted directly it leaves the high-pressure cylinder and removes the necessity of holding the fluid under pressure for a time in a temporary reservoir. This obtains an additional advantage in that there is no great cooling of steam when it is under pressure, and consequently the maximum efficiency from the steam is obtained.

We claim—

1. In a compound blowing-engine, the combination of a high-pressure cylinder, a low-pressure cylinder at right angles to the high-pressure cylinder, a movable piston in each cylinder, one piston having a horizontal and the other a vertical traverse in relation to each other for the advance movement of one piston to be coincident with the return movement of the other piston at the point of greatest power, a compressor-cylinder in line with a pressure-cylinder, a piston in the compressor-cylinder moving in unison with the piston of its alined pressure-cylinder, a crank-shaft at the juncture of the axial lines of the two pressure-cylinders, a connection for the piston of the high-pressure cylinder with the crank-shaft, a connection for the piston of the low-pressure cylinder with the crank-shaft, the two connections standing off center to each other, and means connecting the piston of the compressor-cylinder with the crank-shaft, substantially as described.

2. In a compound blowing-engine, the combination of a horizontal high-pressure cylinder, a vertical low-pressure cylinder, the two cylinders having a right-angle relation to each other, a movable piston in each cylinder for one piston to have its horizontal travel in an advance direction coincident with the vertical travel of the other piston in the return direction at the point of highest power and pressure, a compressor-cylinder in line with the vertical pressure-cylinder, a piston in the compressor-cylinder moving in unison with the piston of the vertical pressure-cylinder, a crank-shaft at the axial line of juncture of the high and low pressure cylinders, a connection for the piston of the horizontal high-pressure cylinder with the crank-shaft, a connection for the piston of the low-pressure cylinder with the crank-shaft, the two connections having an off-center relation to each other, and a connection between the pistons of the compressor-cylinder and the vertical low-pressure cylinder, substantially as described.

3. In a compound blowing-engine, the combination of a high-pressure cylinder arranged in a horizontal plane and provided with a movable piston having an extending piston-rod, a cross-head to which the piston-rod is secured, a low-pressure cylinder arranged in a vertical plane and provided with a movable piston and an extending piston-rod, a compressing-cylinder arranged in a vertical plane above and in line with the low-pressure cylinder, a compressing movable piston in the compressing-cylinder provided with a piston-rod, a cross-head to which the piston-rod of the low-pressure piston and the compressing-piston are connected, a crank-shaft, a wrist-pin for the crank-shaft, arranged substantially at the point where the axial lines of the cylinders meet, connecting-rods connecting the cross-head of the low-pressure piston to the wrist-pin, and connecting-rods pivotally connected in the same vertical plane to the low-pressure connecting-rods and the cross-head of the high-pressure cylinder, substantially as described.

4. In a compound blowing-engine, the combination of a horizontal high-pressure cylinder, a vertical low-pressure cylinder, the two cylinders having a right-angle relation to each other, a movable piston in each cylinder for one piston to have its horizontal travel in an advance direction coincident with the vertical travel of the other piston in the return direction at the point of highest power and pressure, a compressor-cylinder in line with the vertical low-pressure cylinder, a piston in the compressor-cylinder moving in unison with the piston of the alined low-pressure cylinder, a crank-shaft transversely of the cylinders at the axial line of juncture for the two pressure-cylinders, a crank at each end of the crank-shaft, a wrist-pin on each crank, a rod for each wrist-pin connecting the crank-shaft with the cross-head of the low-pressure and compressor cylinders, an offset at the lower end of each connecting-rod at the wrist-

pin and a rod connecting each offset with the cross-head of the high-pressure cylinder at the offset, substantially as described.

5. In a compound blowing-engine, the combination of a horizontal high-pressure cylinder, a vertical low-pressure cylinder, the two cylinders having a right-angle relation to each other, a movable piston in each cylinder, a piston-rod for each piston, a cross-head for each piston-rod, a compressor-cylinder in line with the vertical low-pressure cylinder, a piston in the compressor-cylinder, a piston-rod connecting the piston of the compressor-cylinder with the cross-head of the piston-rod for the vertical low-pressure cylinder, a crank-shaft transversely of the high and low pressure cylinders at the axial line of juncture, a crank at each end of the crank-shaft, a wrist-pin on each crank, a rod for each wrist-pin extending vertically and connecting with the cross-head of the vertical low-pressure and compressor cylinders, an offset at the lower end of each vertical connecting-rod adjacent to the wrist-pin and a horizontal rod extending from each offset to and connecting with the cross-head of the horizontal high-pressure cylinder for operating the pistons of the high-pressure and low-pressure cylinders at the point of highest operation in the compressor-cylinder, substantially as described.

6. In a compound blowing-engine, the combination of a high-pressure cylinder, a low-pressure cylinder having a right-angle relation to the high-pressure cylinder, a compressor-cylinder in alinement with a pressure-cylinder, a piston in the high-pressure cylinder and a piston in the low-pressure cylinder, a piston in the compressor-cylinder moving in unison with the piston of the pressure-cylinder in alinement with the compressor-cylinder, a crank-shaft common to all three of the cylinders, and a differential connection for the pistons of the high and low pressure cylinders with the crank-shaft whereby the high-pressure cylinder is effecting its maximum power when the compressor-cylinder is operating at the point of compression to the greatest density, substantially as described.

7. In a compound blowing-engine, the combination of a horizontal high-pressure cylinder, a vertical low-pressure cylinder, the two cylinders having a right-angle relation to each other, a compressor-cylinder in alinement with the low-pressure cylinder, a piston in each of the pressure-cylinders and a piston in the compressor-cylinder moving in unison with the piston of the low-pressure cylinder, a piston-rod for each piston, a crank-shaft common to all of the piston-rods, a connection for the piston-rod of the vertical low-pressure cylinder with the crank-shaft at the end of the crank, and a connection for the piston-rod of the horizontal low-pressure cylinder with the crank-shaft at a point between the connection for the vertical piston-rod and the shaft for exerting the maximum power of the pressure-cylinders when the compressor-piston is acting at the point of compression for greatest density and for exerting the least power for the pressure-cylinders when the compressor-piston is at the point of least efficiency, substantially as described.

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