No. 805,843. PATENTED NOV. 28, 1905.

H. L. DOHERTY.

AIR OR GAS COMPRESSOR.

APPLICATION FILED FEB. 27, 1904.

3 SHEETS—SHEET 1.

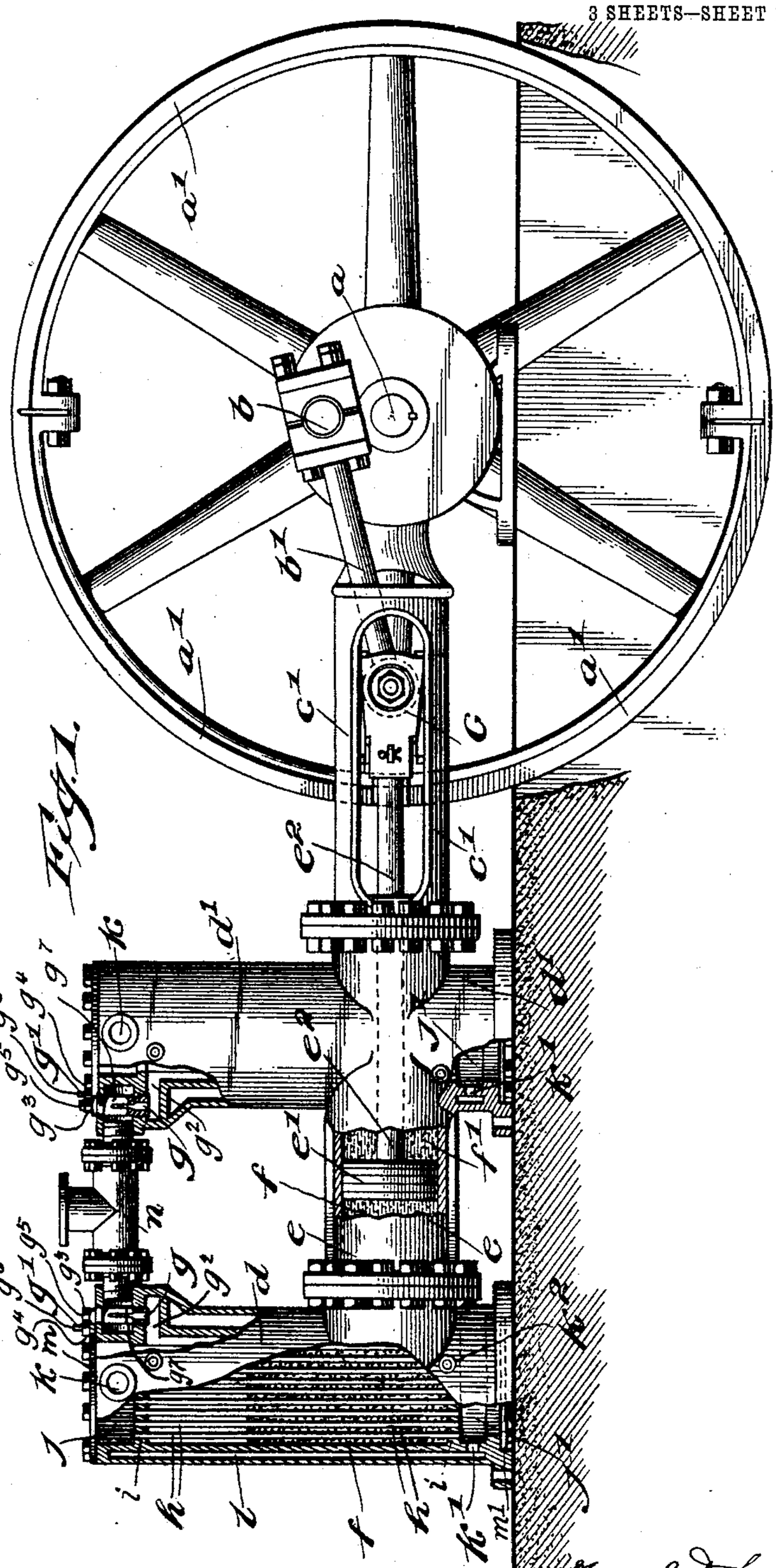

Fig. 1.

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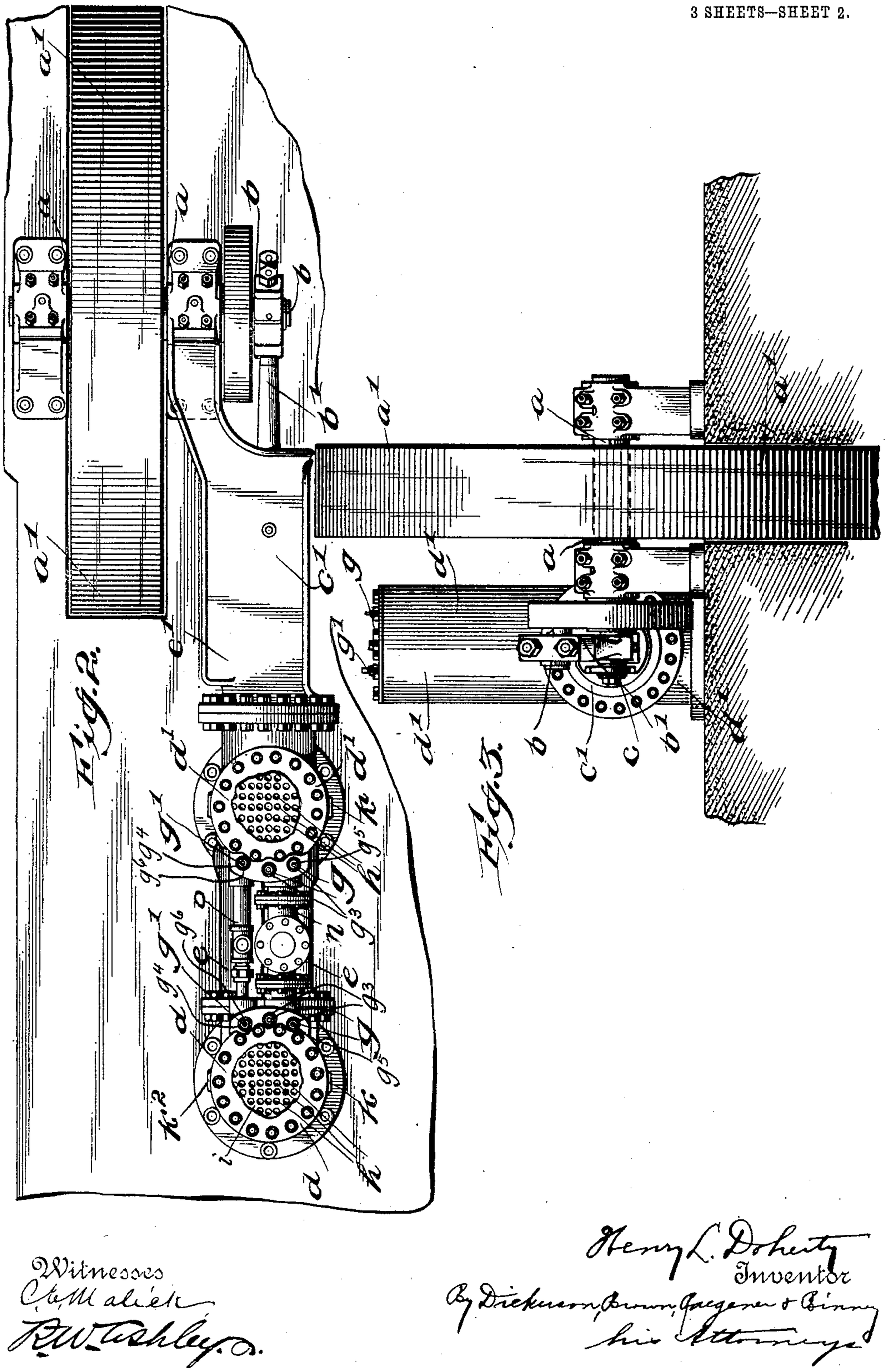


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3 SHEETS—SHEET 3.

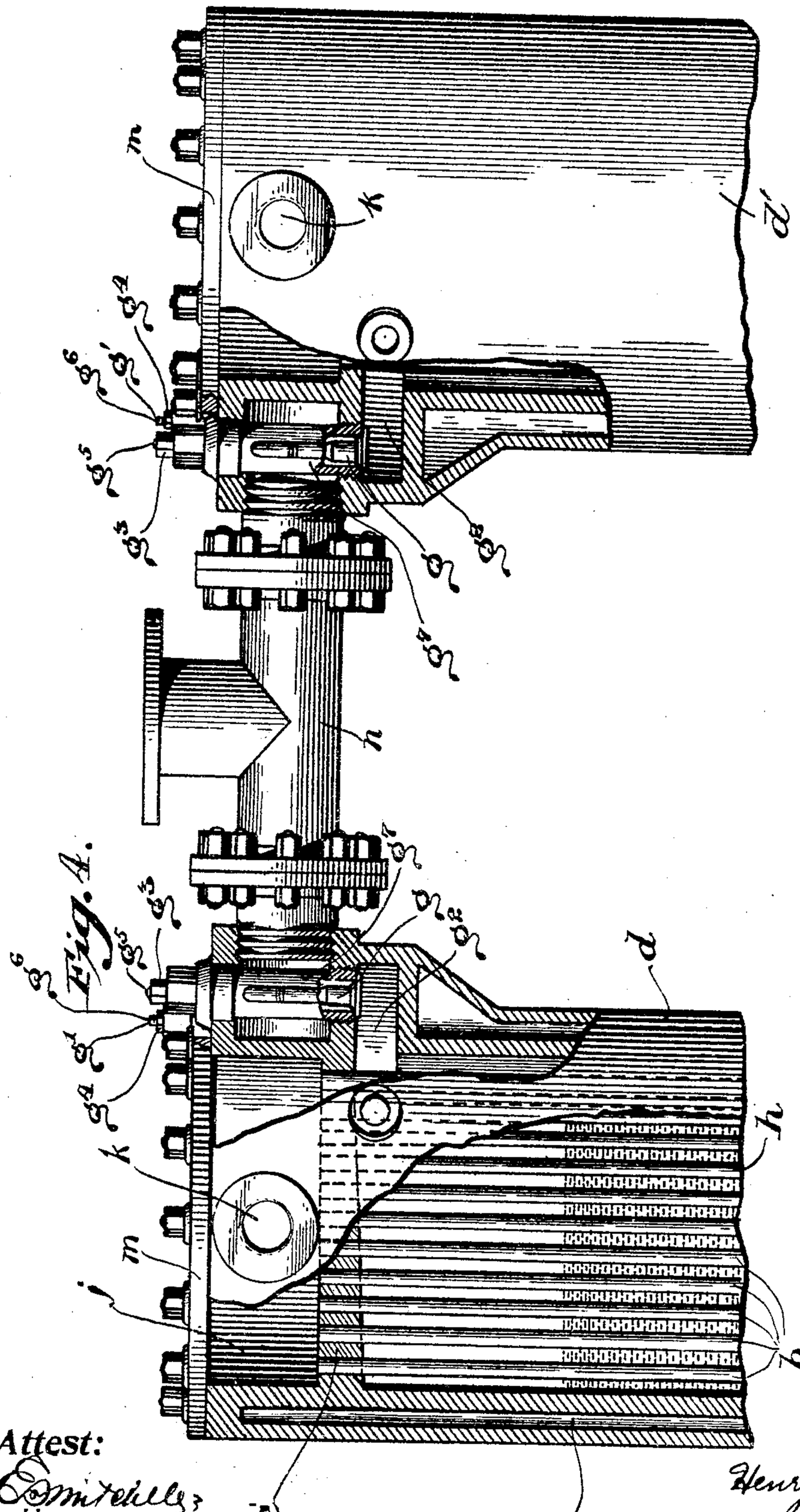


Fig. 4.

Attest:

E. Mitchell;

A. L. O'Brien

Inventor:

Henry L. Doherty

by Dickerson, Brown, Raegener & Brinsey Attys.

# UNITED STATES PATENT OFFICE.

HENRY LATHAM DOHERTY, OF MADISON, WISCONSIN.

## AIR OR GAS COMPRESSOR.

No. 805,843. Specification of Letters Patent. Patented Nov. 28, 1905.

Application filed February 27, 1904. Serial No. 195,529.

*To all whom it may concern:*

Be it known that I, HENRY LATHAM DOHERTY, a citizen of the United States, residing at Madison, in the county of Dane and State of Wisconsin, have invented certain new and useful Improvements in Air or Gas Compressors, of which the following is a specification.

This invention relates to air or gas compressors; and the principal object of the invention is to provide an air or gas compressor in which compression takes place isothermally, or nearly so, thus reducing the thermal losses and requiring less work to be done in compression.

A further object is to eliminate the clearance-space usual to most air or gas compressors.

Further objects are to provide reliable, efficient, and economical means for compressing air or gas.

In order that my invention may be fully understood, I will now proceed to describe the same, with reference to the accompanying drawings, which show a desirable form of my invention, and in which drawings—

Figure 1 is a side elevation, partly in section and parts broken away, showing my improved air or gas compressor. Fig. 2 is a plan view, partly broken away; and Fig 3 is an end elevation of the same viewed from the right-hand end of Fig. 1. Fig. 4 is an enlarged detail sectional side elevation, partly broken away, showing the construction of the valves and valve-chambers.

Referring to the drawings, the means for driving the air or gas compressor is shown to comprise a power-shaft *a*, provided with a fly-wheel *a'*, with which is eccentrically connected, by means of a wrist-pin *b*, a pitman *b'*, which is connected with a cross-head *c*, guided in a suitable guideway or casing *c'*. The guideway or casing *c'* is suitably connected with or mounted on the air or gas compressor. It is evident that any suitable means for operating the compressor may be resorted to—as, for instance, a steam-engine, gas-engine, electric motor, water-motor, or any other suitable source of power either belted, geared, or directly connected to the compressor. In the form of the invention shown there are two compression-chambers *d d'*, which are arranged in upright position and are connected at their lower ends by means of a cylinder *e*, which is bolted or otherwise suitably connected with the said chambers. The cylinder *e* is here horizontal for guiding a horizontally-reciprocated piston-head *e'*, the piston-rod $e^2$ of which is connected with the cross-head *c*. The piston-head *e'* is packed in any usual well-known manner. The function of the piston-head *e'* is for the purpose of causing the reciprocation or pulsation of fluid-pistons *f f'* at opposite faces of the piston-head. The fluid-pistons *f f'* are by the reciprocation of the piston-head moved, respectively, into the compression-chambers *d d'* for the purpose of compressing the air or gas admitted alternately into said compression-chambers. The fluid-pistons extend into the said compression-chambers, which latter may be of any desirable number and each of which for the purpose of admitting air or gas is provided with an inlet-valve *g* and for the purpose of exhausting or delivering the compressed air or gas an outlet-valve *g'*. The action of these valves is well known, it being understood that when the fluid-piston, as *f*, is drawn inwardly or downwardly air or gas is sucked into the compression portion of the chamber *d*, and when the fluid-piston is pushed outwardly or upwardly the air or gas is to a certain extent compressed in the said compression portion of the chamber *d*, and when a sufficient pressure has been established the outlet-valve *g'* is opened automatically. The inlet and outlet valves *g g'* are so arranged in relation to the compression-cylinder and to the compression-space therein that access may be readily had thereto for inspection and repairs. In order to provide for such access, the compression-chambers are provided with laterally-extending portions $g^2$, which in this instance extend inwardly toward each other. In the tops of these portions are provided seats for the inlet-valves *g*, which communicate with the atmosphere or with the gas-reservoir of the gas to be compressed by means of the supply-pipe *n*. Seats are also provided in the roof of the chambers $g^2$ for the outlet-valves *g'*, which communicate with any suitable reservoir for receiving the compressed air or gas. By simply unscrewing the nuts $g^3$ and $g^4$ the caps over the inlet and outlet valve chambers may be removed and access had to the valves. It will be seen that the nuts referred to are carried upon spindles $g^5$ and $g^6$, which are formed as projections from cylindrical screw-threaded valve-seats $g^7$, which are adapted to be screwed into the roof of the chambers $g^2$. The valve-seats are first removed in order to remove the inlet-valves. For attaining the end in view—that is to say, the isothermal

compression of the air or gas, or substantially so—each compression-chamber *d d'* (the internal construction of chamber *d* being only shown, as that of *d'* is the same) is provided with a series of tubes *h*, similar to the tubes of a tubular boiler, for instance, which tubes are connected at their opposite ends with tube-plates *i*, located within the compression-chamber. The space not occupied by the tubes *h* contains the fluid-piston or a substantial portion thereof and the compression-space for the air or gas, with which space the valves *g g'* are connected. Water-containers *j j'* are preferably located at each end of the compression-chambers *d* or *d'*, a water-inlet *k* leading to the water-container *j* and a port *k'* connecting the water-container *j'* with a water-jacket *l*, surrounding the compression-chamber *d* or *d'*, said water-jacket being in turn provided with an outlet, as $k^2$. The water-containers *j j'* are closed by means of the heads *m m'* of the compression-chamber. It will be seen that cooling-water admitted through inlet *k* will flow or circulate through the tubes *h* and around the jacket *l* and out of the outlet $k^2$, thereby keeping the fluid-piston and also the admitted air or gas cool. By providing the tubular construction shown the columns of air or gas between the tubes are thoroughly cooled during compression until the air or gas is finally expelled by the fluid-piston. Other means for compressing the air or gas isothermally, or nearly so, will readily suggest themselves to those skilled in the art, and I do not, therefore, limit myself to the construction shown, for other means, although possibly not as desirable, are equally available. The circulating or cooling tubes *h* may evidently be of any form or shape and arranged either in horizontal, vertical, or other plane.

Where the compressor is of the duplex or plural type, the inlet-valves *g* of the compression-chambers are preferably connected by a supply-pipe *n* and the outlet-valves *g'* are connected by a discharge-pipe *o*.

Some of the peculiarities of the construction shown are that a cooling medium is circulated through a liquid or fluid piston without contact with it; that the heat of the air or gas under compression may be transferred to a liquid circulated at a lower or a different pressure than the pressure of the fluid or liquid piston; that the cooling-water is entirely surrounded, as it were, by the gas or air being compressed; that a liquid or fluid piston of one character or quality and a cooling liquid of a different character or quality may be used, and that a liquid-piston or fluid-piston may be used in conjunction with internal cooling devices.

The advantages of the invention will be apparent to those experienced.

Evidently any suitable number of compression-chambers more than two could also be employed.

Having thus described my invention and without limiting myself to details or enumerating possible equivalents, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In an air or gas compressor, the combination of a compression chamber or cylinder, tube-plates at each end thereof forming water-containers between the tube-plates and the ends of the cylinder, circulating-tubes secured in the tube-plates and connecting the water-containers, a water-jacket surrounding the said tubes and communicating with one of the water-containers and having an inlet and outlet at the exterior of the cylinder, means for circulating cooling-water through the water-containers, through the connecting-tubes and through the water-jacket, inlet and outlet valves connected with the remaining portion of the space in the cylinder around and between the tubes, and means for forcing an air or gas compressing medium into said space around and between the tubes.

2. In an air or gas compressor, the combination of a compression chamber or cylinder, tube-plates at each end thereof forming water-containers between the tube-plates and the ends of the cylinder, circulating-tubes secured in the tube-plates and connecting the water-containers, a water-jacket surrounding the said tubes and communicating with one of the water-containers, means for circulating cooling-water through the water-containers, through the connecting-tubes and through the water-jacket, the compression-chamber of the cylinder being situated around and between the said tubes and being provided with a laterally-projecting portion at its top, inlet and outlet valves communicating with said projecting portion of the compression-chamber, and means for forcing an air or gas compressing medium into said compression-chamber around and between the tubes.

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

HENRY LATHAM DOHERTY.

Witnesses:

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H. C. ABELL.