No. 706,979.

Patented Aug. 12, 1902.

G. E. MARTIN.

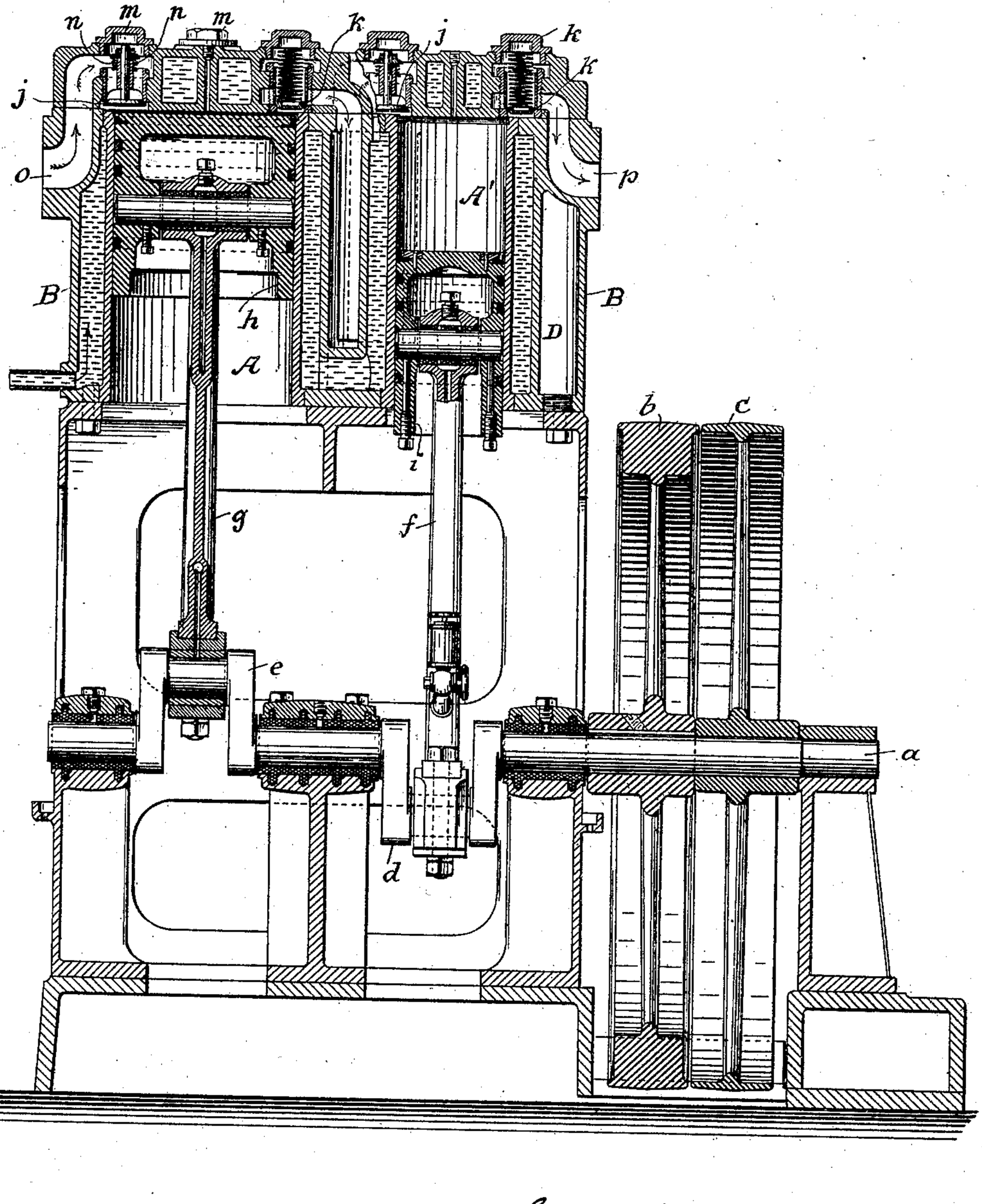
COMPOUND AIR COMPRESSOR.

(Application filed Aug. 15, 1901.)

(No Model.)

4 Sheets—Sheet 1.

Fig 1



Witnesses
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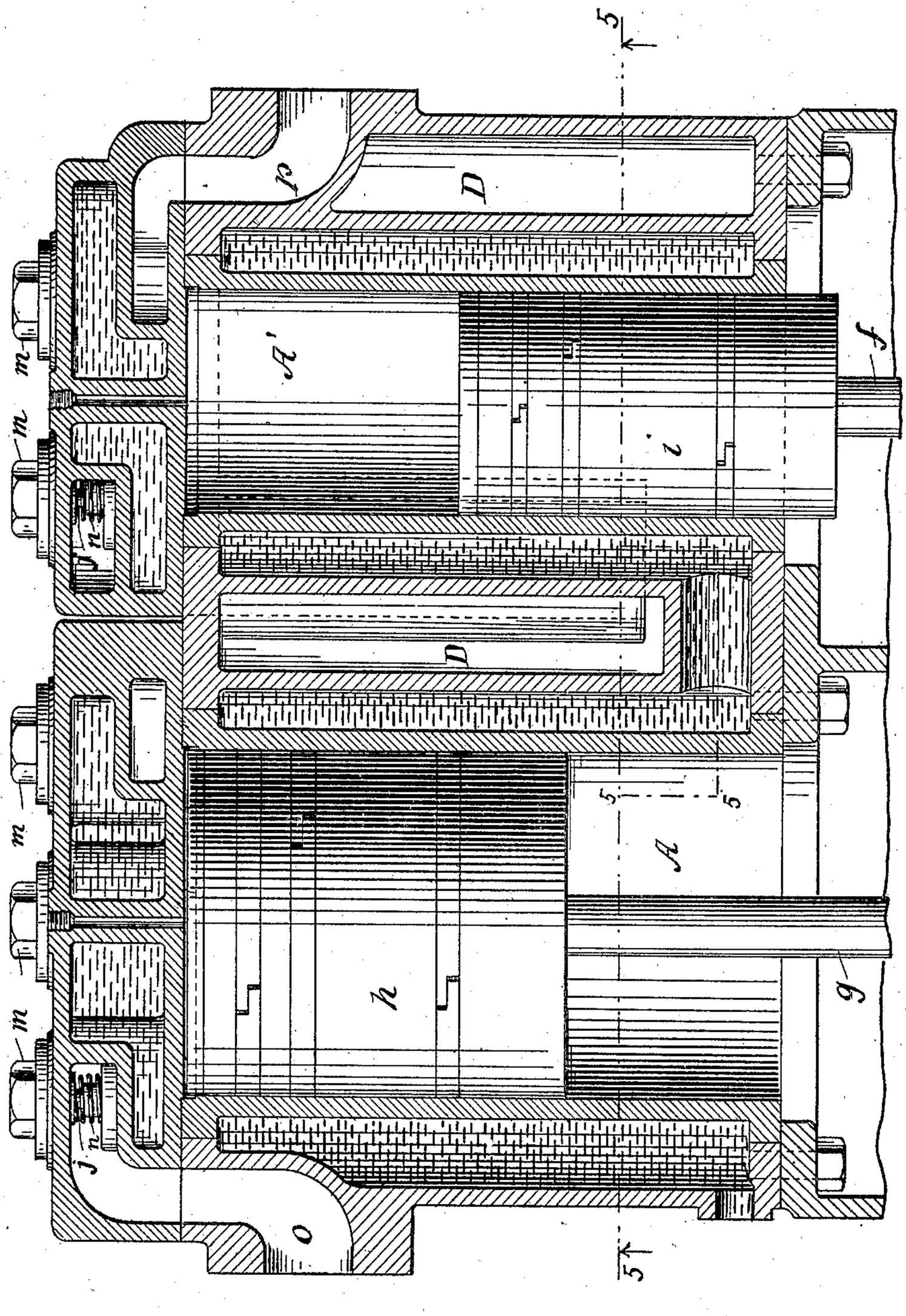
(No Model.) 4 Sheets—Sheet 2.

FIG. 2.



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(No Model.) 4 Sheets—Sheet 3.

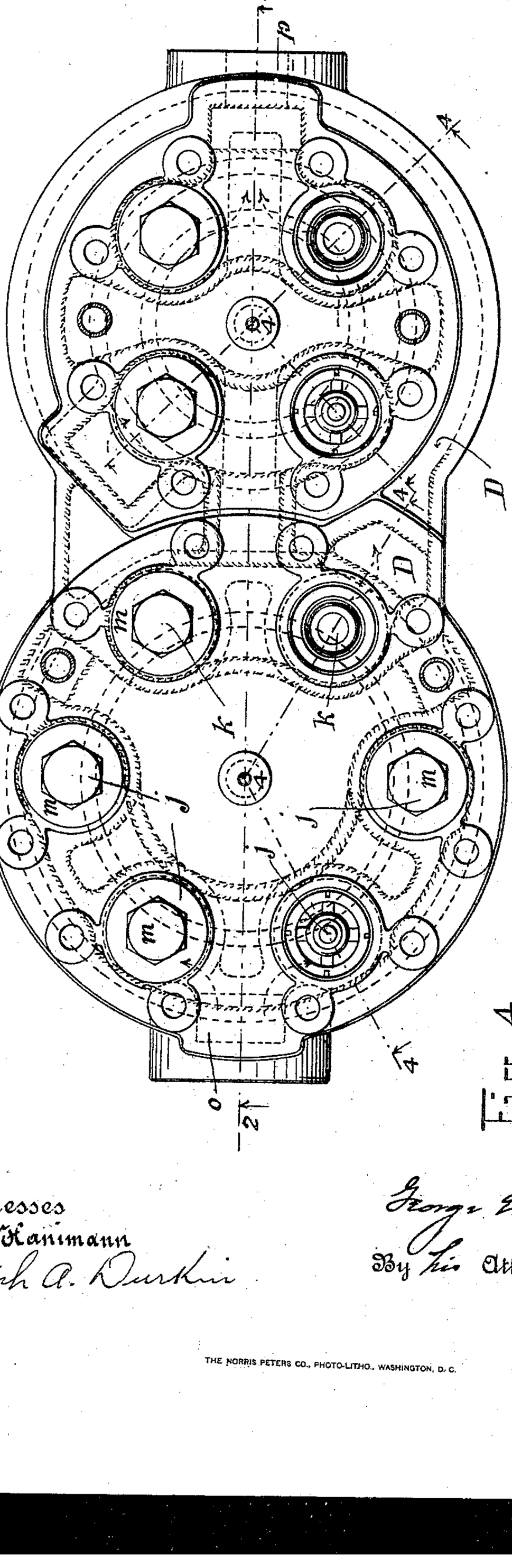

Fig. 3.

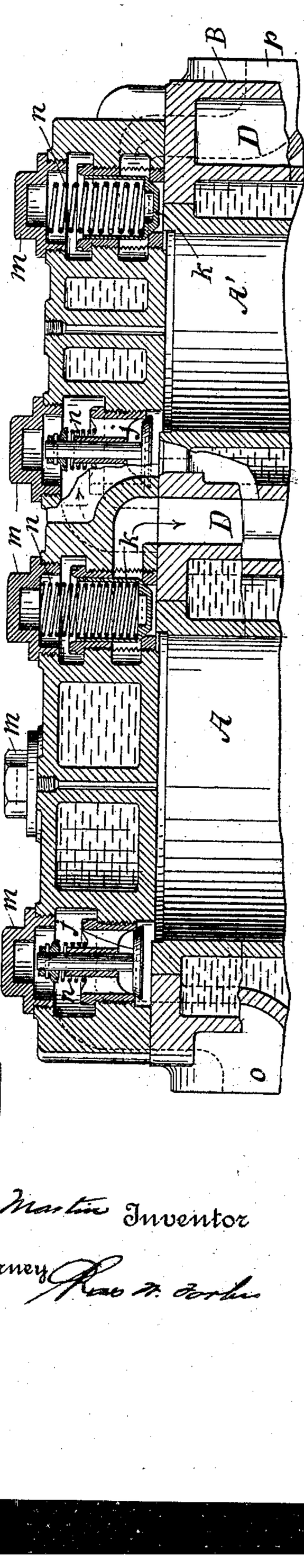

Fig. 4.

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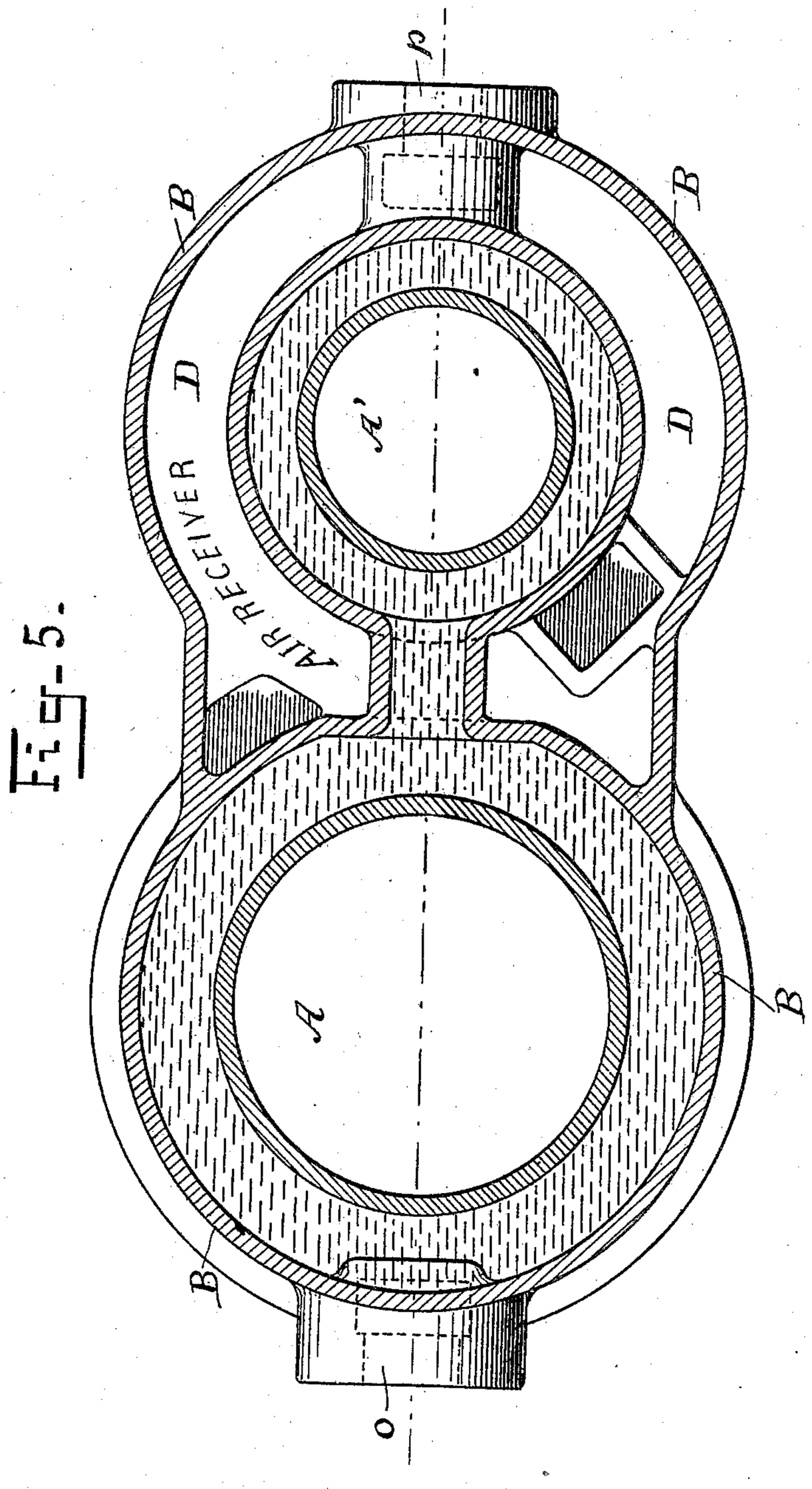
4 Sheets—Sheet 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

GEORGE E. MARTIN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE PEDRICK AND AYER COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

COMPOUND AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 706,979, dated August 12, 1902.

Application filed August 15, 1901. Serial No. 72,115. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. MARTIN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Compound Air-Compressors, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in compound air-compressors; and it consists in the relative arrangement with the circulating water-jackets that surround the compression-cylinders and valve-chambers of the air-passages and air-receiving chambers, whereby a material reduction of the temperature of the air is maintained under the reduction in its volume, all as hereinafter more particularly described, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a vertical section of the air-compressor. Fig. 2 is an enlarged vertical section of compression-cylinders on line 2 2 of Fig. 3. Fig. 3 is a top view of cylinder covers and valves. Fig. 4 is a vertical section through cylinder covers and valves on lines 4 4 4 4 4. Fig. 5 is a horizontal section through cylinders on line 5 5 of Fig. 2.

The larger compression-cylinder is represented by A and the smaller cylinder by A′, and the details of their construction and the operative parts are hereinafter referred to by letters of reference which denote similar detail parts in the respective figures. The operative parts include the main driving-shaft *a*, provided with the fast and loose band-wheels or belt-pulleys *b c*, the cranks *d e*, connecting-rods *f g*, and pistons *h i*, together with the induction and discharge valves lettered, respectively, *j* and *k*, all relatively located in a manner common to this type of compressor. The outer shell B includes both the larger and smaller compression-cylinders forming part of the shell of the water-jacket of the larger cylinder and the outer shell of an air-receiving chamber D, that embraces the water-jacket of the smaller cylinder, as shown in plan on the enlarged sectional view, Fig. 5. The inner wall of the air-receiving chamber or cooler D is therefore completely exposed to the circulating water-jackets and its outer wall or shell to the atmosphere, and the temperature of the air is by this construction consequently reduced to the minimum degree possible in the utilization of the circulating water-jackets of the operative cylinders. In this invention it will be observed that a constant cooling effect is produced from the initial compression of the air in the larger cylinder throughout its course through the compressor, and consequently the minimum degree of temperature and maximum efficiency possible in practice are obtained. The effect of this intermediate receiver or intercooler D, whereby the temperature is materially reduced, is to also reduce the volume of air discharged from the larger cylinder, which will increase the efficiency of the compressor by the admission and manipulation of an increased quantity of air of greater density to the smaller cylinders under a given pressure. This air-receiving chamber or intercooler D is in practice about two and one-half times larger in capacity than the piston-displacement in the larger cylinder A, and a constant pressure is maintained therein that will force the confined air through the induction-valves and fill the smaller cylinder A′. This pressure from the air-receiver or intercooler D also acts to assist the downward stroke of the smaller piston, and thereby a degree of mechanical work is derived equivalent to the use of less operative power. Upon the return or compressing stroke of the smaller piston the volume of the confined air is still further compressed in the usual way, the consequent increase of temperature being checked by the effect of the surrounding water circulation.

The induction and discharge valves *j* and *k* are located in chambers provided in the top heads of the respective cylinders A A′, covered with caps or bonnets *m* and normally held to their seats by springs *n*, as shown in the respective figures.

The operation of the compressor may be readily understood from the drawings. By the first downward movement of the large piston the air enters through the inlet-port *o* and through the air-spaces formed in the cylinder-head, as outlined in the plan view, Fig.

3, and passes into the larger cylinder through its induction check-valve *j*, which opens inwardly and automatically closes at the completion of the downward stroke of the piston or commencement of its return compression-stroke. The larger cylinder being now filled, the upward and compression movement of the piston opens the discharge-valve, allowing the air to pass to the receiving-chamber or cooler D. Upon the following downward movement of the piston *i* of the smaller cylinder the air under compression in the receiver or intercooler D enters the smaller cylinder through its induction or check valve *j*, and upon the return or compression movement of the smaller piston the air is discharged through its discharge-valve *k* and passage *p* to a suitable storage-reservoir.

The regulation of the operation of the compressor as to the desired degree of compression and the adjustment of the parts, such as the variable requirements in the tension of the springs that maintain the valves in their proper normal position, will be readily understood by those skilled in the manufacture and use of inventions of this character.

What I claim, and desire to secure by Letters Patent, is—

1. A compound air-compressor provided with an air-receiver intermediate of and adjacent to the respective compression-cylinders having its inner wall in contact with the circulating water-jackets of said cylinders, and cooling-jackets inclosing the connecting air-spaces, whereby the air is in contact with cooled surfaces during the entire period of its passage, as set forth.

2. In a compound air-compressor, an air-receiver intermediate of and adjacent to the respective compression-cylinders having its inner wall in contact with the circulating water-jackets of said cylinders and its outer wall exposed to the atmosphere as set forth.

3. A compound air-compressor having an air-receiver intermediate of the respective compression-cylinders, its inner wall forming the outer surrounding wall of the circulating water-jacket of the smaller cylinder and adjacent wall of the water-jacket of the larger cylinder, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE E. MARTIN.

Witnesses:

THOMAS HEWETT,

J. W. RITTER.