No. 768,691. PATENTED AUG. 30, 1904.

W. R. PRATT.

AIR ENGINE.

APPLICATION FILED DEC. 28, 1901.

NO MODEL.

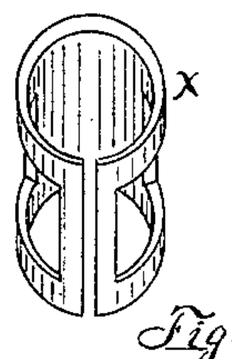

Fig. 6.

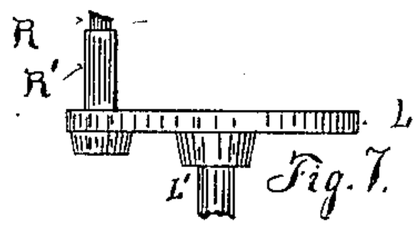

Fig. 7.

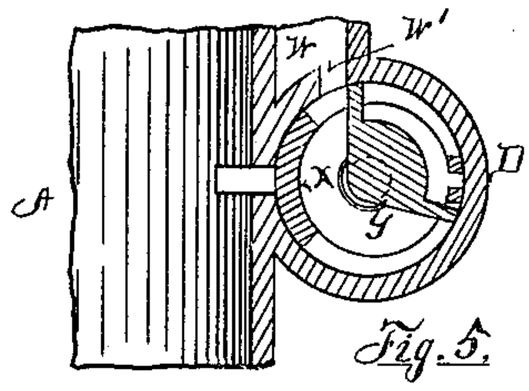

Fig. 5.

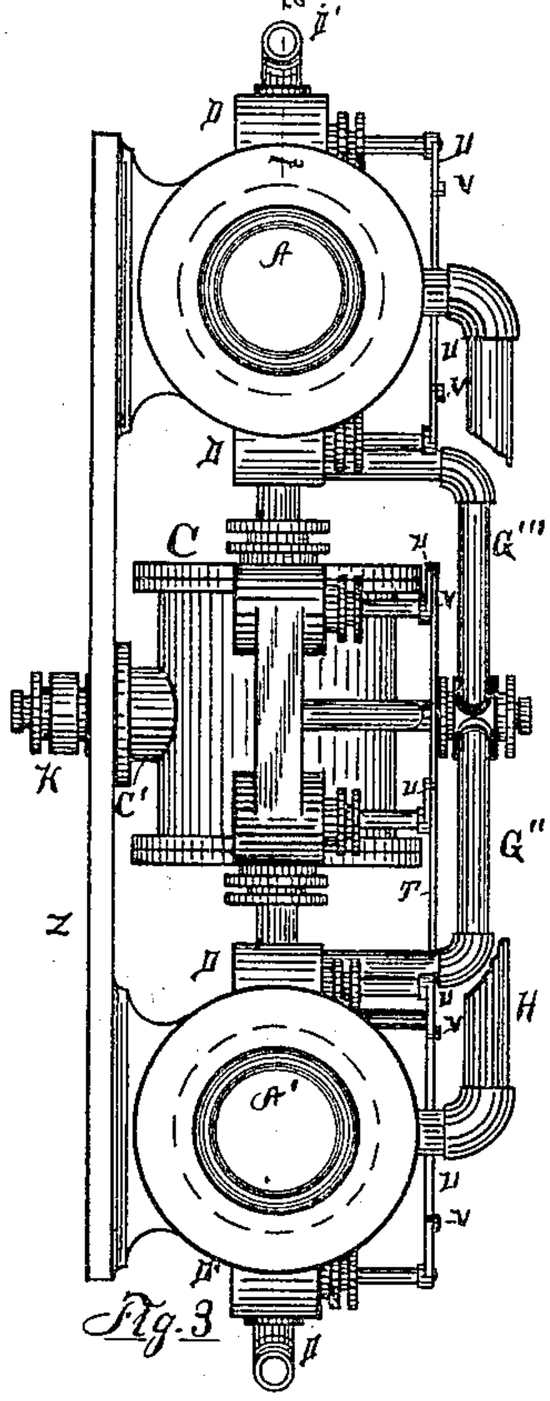

Fig. 3

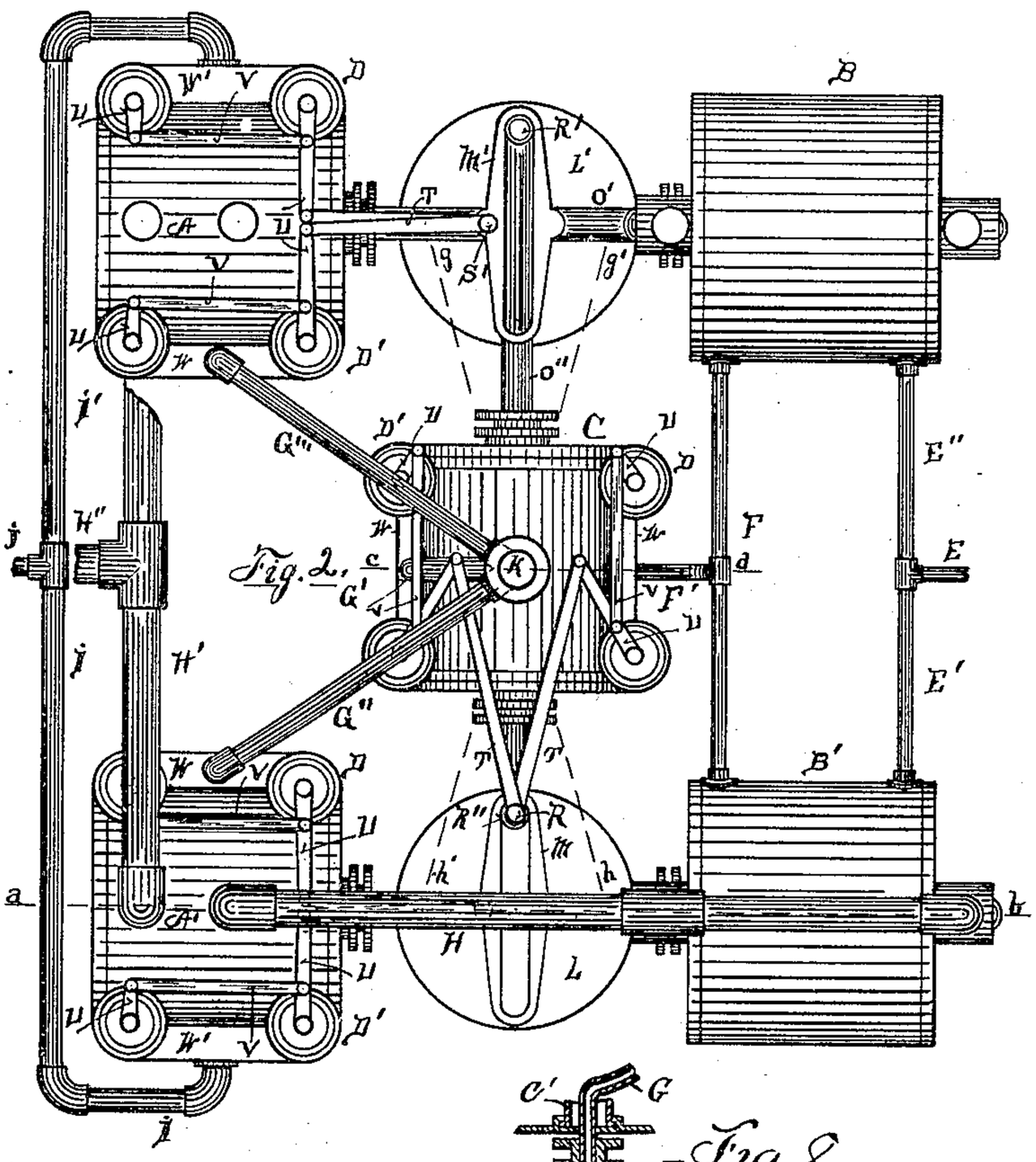

Fig. 2.

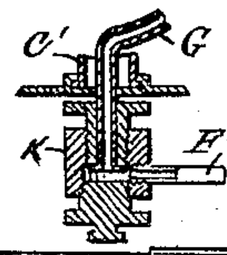

Fig. 8.

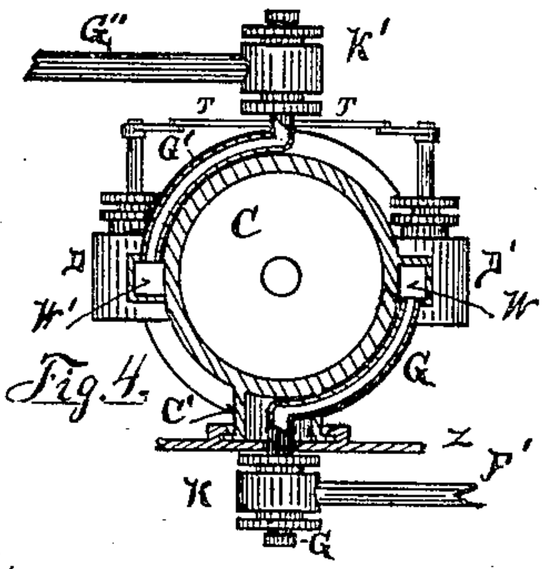

Fig. 4.

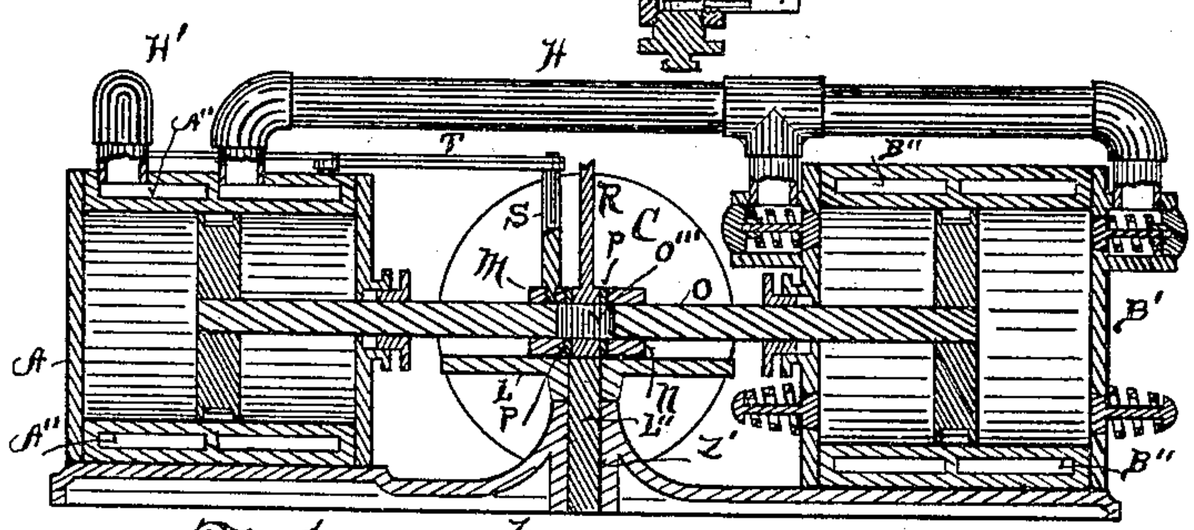

Fig. 1.

Witnesses.

M. W. Gilmore

J. A. Hunt

Inventor.

Wilson R. Pratt.

By his Attorney

F. M. Comstock

No. 768,691. Patented August 30, 1904.

UNITED STATES PATENT OFFICE.

WILSON R. PRATT, OF TOPEKA, KANSAS.

AIR-ENGINE.

SPECIFICATION forming part of Letters Patent No. 768,691, dated August 30, 1904.

Application filed December 28, 1901. Serial No. 87,603. (No model.)

To all whom it may concern:

Be it known that I, WILSON R. PRATT, a citizen of the United States, residing at Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Air-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to air-engines wherein the fluid air stored at a high pressure is utilized during its reduction to a low pressure as initial energy for the compression of free air.

The compressors as devised are compounded, there being an oscillating primary engine receiving air at a high pressure and exhausting into two straight-line engines, the said exhaust forming initial energy for the straight-line engines—that is, engines in which their pistons travel only in a straight line. The oscillating primary engine is a portion of the mechanism constituting a toggle-joint which exerts its extreme of stress at a time when most required in the compression of free air. As the compression of air generates heat, I take advantage of this fact in so utilizing the heat units, adding them to the expanding cold air, that I get an economic result, and, vice versa, I utilize the cold produced by the expansion of compressed air in storage in reducing the heat generated by the compression of free air, to the end that the product of the compressors be greater in air at normal temperature, thus securing a secondary economy in product.

The air-compressors as devised constitute a component part of a compressed-air locomotive wherein compressed air in storage forms the initial energy.

I attain these objects by the devices and mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view taken through the line *a b* of Fig. 2. Fig. 2 is an incomplete plan view showing the general arrangement of the compressors and engine, but excluding the base to which they may be attached. Fig. 3 is an end view or elevation of Fig. 2. Fig. 4 is a tranverse section taken through the line *c d* of engine C, Fig. 2. Fig. 5 is a transverse section of the valve-chest, taken through the line *e f* of Fig. 3. Fig. 6 is a perspective of the valve proper. Fig. 7 is a detail of crank-disk and crank-pin, and Fig. 8 is a detail sectional view of one of the valves. All of the views are in a measure distorted for the purposes of better illustration.

Similar letters refer to similar parts throughout the several views.

In my invention A A′ are straight-line engines, B B′ representing the air-compressors.

C is the oscillating primary engine.

As shown in Fig. 1, the engines A A′ and air-compressors B B′ have an annular open space A″ B″, respectively, formed in their casings. The engines A A′ and C have especially-designed semirotating inlet and exhaust valves, as shown at D and D′ in the several views. The valves are connected with a conduit W with ports W′, (see Fig. 5,) opening into the valve-chambers. The straight-line engines outside the valves may be of the usual construction as to cylinder-heads, piston-heads, stuffing-boxes, &c.

Outside the double cylinder no special claim is made in the construction of the air-compressors.

The novel and valuable features of my invention consist of, first, the oscillating primary engine C, which oscillates in its step C′. The piston-rod O″ of this engine is connected at one end with the crank-pin R′ of the crank-disk L′ and at its other end with the crank-pin R″ of the crank-disk L, said crank-disks rotating on the studs L″, operating in the bearing Z′ of the base Z. The rotation of the said disks is secured by the combined reciprocations of the piston-rods O, O′, and O″, the oscillations of the engine C being shown by the dotted lines *g h g′ h′*. The disk crank-pins R′ R″ play in the double-bow stirrups M N and M′ N′, and in the rotations of the crank-disks, produced, as described, by the reciprocation of the piston-rods of these engines, the ex-

treme of pressure in the air-compressors is overcome by the oscillating primary engine C by exerting the extreme of its power in forcing the crank-pins R′ R″ over the toggle-joint centers *g h* and *g′ h′*. The dead-centering points of the toggle-joints being passed, the straight-line engines take up their work of performing the first three-fifths of the stroke. As an antifrictional device the roller P, (see Fig. 1,) may be placed on the disk crank-pin.

In the oscillating primary engine C the valves are semirotated in the valve-chest by means of the stud R, which may be an upwardly-extending part of the crank-disk pin R″, the valve-rods T T′, the valve-levers U, connecting-rods V, and valve-dogs Y. (See Fig. 5.) In the straight-line engines the studs S S′ rise from the doubled-bow stirrup, as shown in Figs. 1 and 2. The studs S, S′, and R move with the piston-rods of the engines and through their connections, as described, operate the valves thereof.

In operation my invention works as follows: Highly-compressed air is admitted to the conduit-pipe E by means of a suitable valve. The said air passes into the jackets of the air-compressors B′ B through the pipes E′ E″. The said air-compressors in compressing free air generate heat, a certain per cent. of which is taken up by the air to be used in the form of energy in the engines. After the passage of the air through the space formed by the jackets, as shown at B″, Fig. 1, it passes into the pipe F and thence into the pipe F′, whence by means of the stuffing-box K it passes into the pipe G, the conduit W, and through the ports W′ into the valve-chest D′. (See detail, Fig. 4.) After doing its work in the engine C the air passes through the exhaust-valve chest D and by the connecting-conduit W′ into the exhaust-pipe G′, thence through the stuffing-box K′ into the pipes G″ G‴, which lead to the valve-chests of the straight-line engines, and operates the pistons therein, the air finally passing through the exhaust-chest of the said engines into the pipes I I′ and by the pipe J into the tank of low pressure. The air compressed by the air-compressors B B′ passes through the pipes H into the space A″, (see Fig. 1,) formed by jacketing the straight-line engines. As the air thus compressed carries with it a greater portion of the heat generated in its compression, it fills its function by heating the cylinders of the straight-line engines, and thereby adding heat units to the air used as energy in the said cylinders. Having fulfilled its function, as stated, it passes through the pipe H′ and the pipe H″ direct to a heater, where the heat units are further increased just previous to its use in the cylinders of a locomotive.

It will thus be seen that by the aid of my invention great economy must result in the use of compressed air in storage as initial energy, for it will be understood that I am able by this means not only to reduce the high pressure to a low pressure, but to use the differences of pressure in the production of compressed free air. Again, by means of the novel devices herein described I am able to add to the units of energy the greater portion of the heat units produced in compressing free air. Also in the arrangement of the air-compressors as a whole I am able, as described, to secure the greatest amount of power at a time when it is most needed.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of straight-line engines, jackets provided on said straight-line engines, air-compressors communicating with said jackets, said compressors delivering to said straight-line engines, jackets provided on said air-compressors, an oscillating primary engine adapted to exhaust into said straight-line engines, and receiving air from said last-named jackets, substantially as described.

2. The combination with an oscillating primary engine, and its piston-rod, of rotating crank-disks, crank-pins on said disks, said piston-rod being connected to the said pins, double-bow stirrups in which the said crank-pins are arranged, straight-line engines, studs arranged in said bow-stirrups and connected with the said straight-line engines, and an air-compressor connected with said stirrups, substantially as described.

3. The combination with a high-pressure oscillating air-engine, of low-pressure straight-line air-engines receiving the exhaust therefrom, compressors driven by said engines, jackets for the compressors and straight-line engines, means whereby the compressors deliver to the straight-line-engine jackets, and means for conducting the air for the oscillating engine through the compressor-jackets, substantially as described.

4. In a device of the character described, the combination of an oscillating engine, straight-line engines adapted to receive the exhaust therefrom, means for compressing air adapted to be actuated by said engines, said means provided with air-jackets, and means for conducting the air for said oscillating engine through the jacket of said compressing means, substantially as described.

5. The combination with a primary high-pressure oscillating air-engine, of low-pressure straight-line engines receiving the exhaust therefrom, air-compressors actuated by said engines, and means whereby the compressed air by which the primary engine is actuated, is raised in temperature by the heat generated in the air-compressors, substantially as described.

6. The combination with a primary high-pressure oscillating air-engine, of low-pressure straight-line engines receiving the exhaust therefrom, air-compressors actuated by

the said engines, semirotating valves arranged on the high and low pressure engines, means connected with said engines for operating said valves and means whereby the air by which the primary engine is actuated is caused to absorb heat generated in the compressors, substantially as described.

7. The combination with a high-pressure primary oscillating air-engine, of low-pressure straight-line engines receiving exhaust therefrom, jackets formed upon said last-named engines, compressors driven by said engines, jackets formed upon said compressors, means connecting said compressors with said jackets of the straight-line engines whereby the said compressors deliver thereto, means whereby the air for the oscillating engine passes through the said compressor-jackets, and means connecting said primary engine with the said straight-line engines and compressor-jackets.

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

WILSON R. PRATT.

Witnesses:
W. M. CLINTOCK,
F. O. BURKET.