(No Model.)

2 Sheets—Sheet 1.

E. R. POWELL.

Atmospheric Engine.

No. 231,971. **Patented Sept. 7, 1880.**

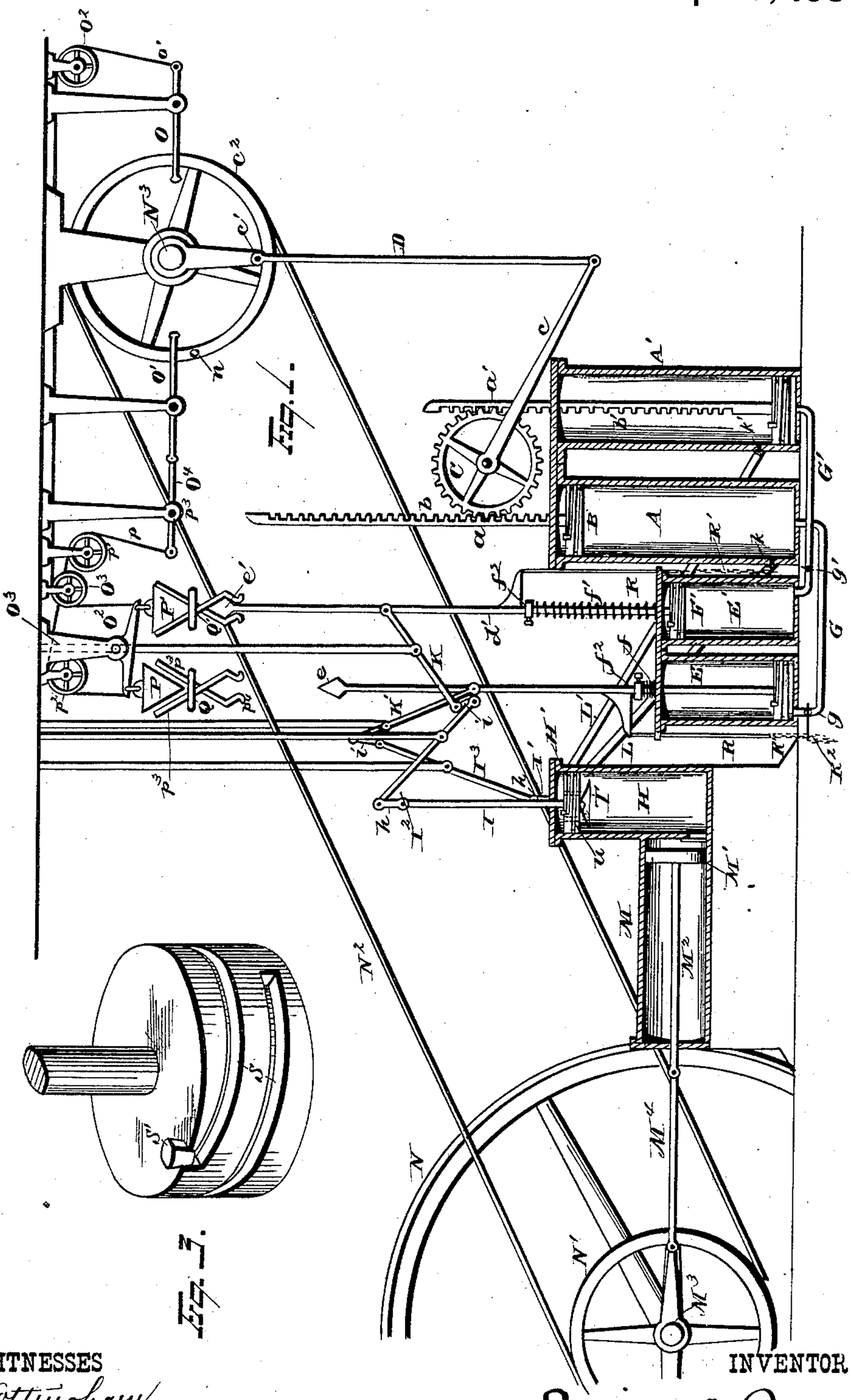

Fig. 1.

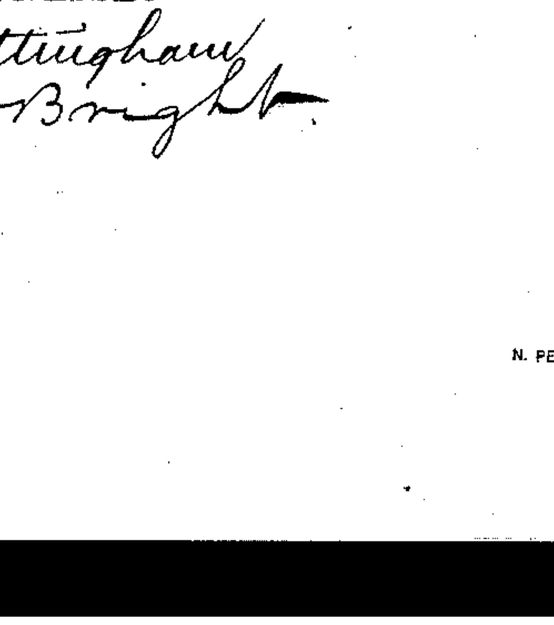

Fig. 2.

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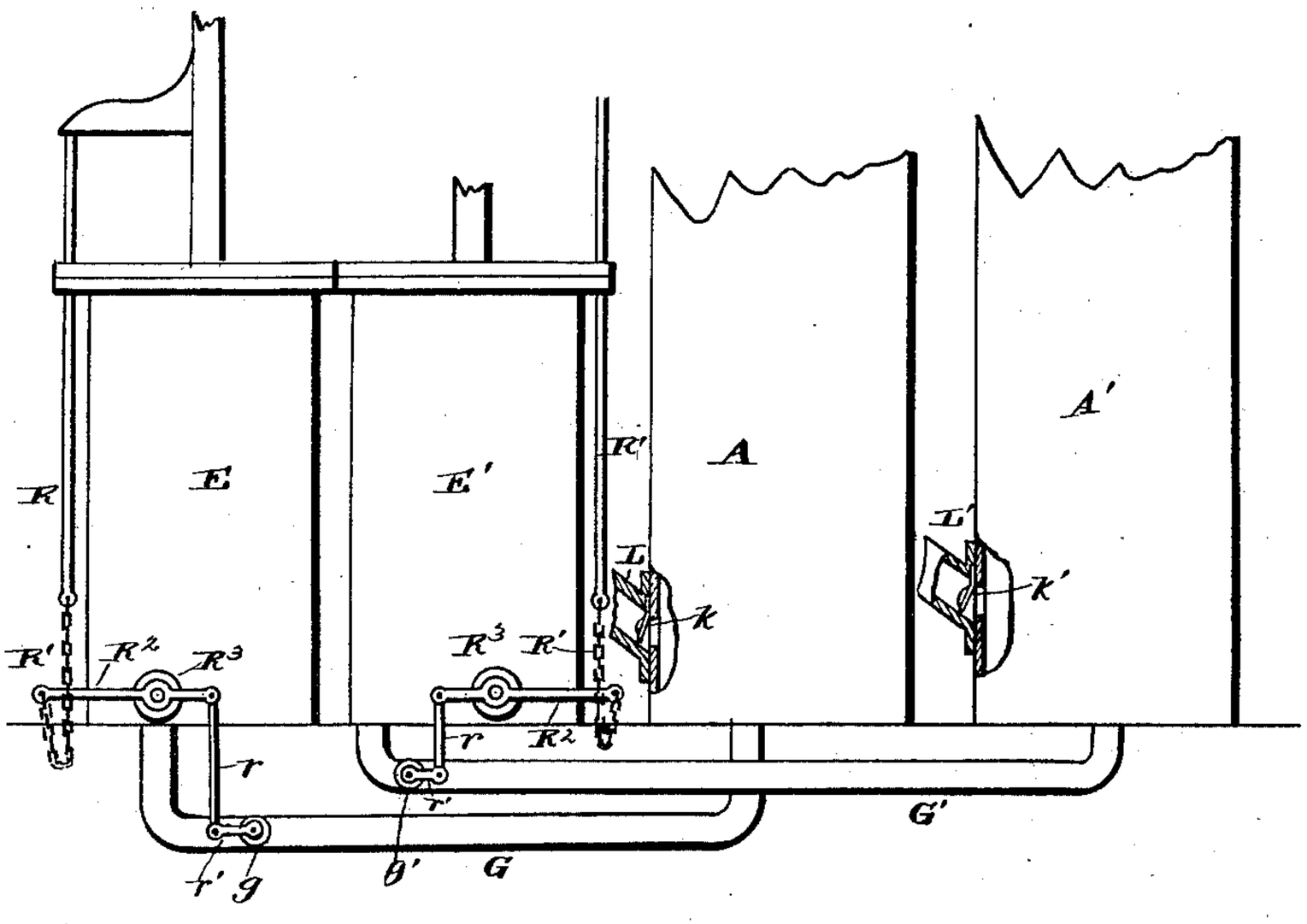

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UNITED STATES PATENT OFFICE.

EDWIN R. POWELL, OF BURLINGTON, VERMONT.

ATMOSPHERIC ENGINE.

SPECIFICATION forming part of Letters Patent No. 231,971, dated September 7, 1880.

Application filed July 10, 1880. (No model.)

To all whom it may concern:

Be it known that I, EDWIN R. POWELL, of Burlington, in the county of Chittenden and State of Vermont, have invented certain new and useful Improvements in Atmospheric 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in atmospheric engines, the object being to provide an engine or motor of such construction that atmospheric pressure may be utilized in compressing air for operating the engine and with this end in view; my invention consists in an engine or motor embodying certain arrangement of parts and features of construction, as will hereinafter be explained, and pointed out in the claims.

In the accompanying drawings, Figure 1 represents a view, partly in section, and partly in side elevation, of a motor or engine constructed in accordance with my invention. Fig. 2 is a detached view of the mechanism for operating the valves. Fig. 3 is a view, in perspective, of one of the pistons.

A A′ represent two exhaust-cylinders, provided, respectively, with pistons B B′, which are packed in any approved manner to work air-tight in the cylinders. Piston-rods *a a′* have racks *b b′* formed thereon, said racks being arranged to mesh with the opposite sides of a gear-wheel, C, and located in such relative vertical positions that as the gear-wheel is revolved one of the pistons will be raised and the other piston be forced through its downstroke; thus, when the piston B is at the upper end of cylinder A the piston B′ will be at the lower end of cylinder A′. To gear-wheel C is secured an arm, *c*, to the outer end of which is pivoted the lower end of a pitman, D, the upper end of which is journaled upon a crank-pin, *c′*, attached to the band-pulley c^2.

By imparting a complete revolution to band pulley or wheel c^2 a complete stroke in opposite directions will be imparted to the pistons B B′.

At any convenient point are located the receiving-cylinders E E′, which are of only one-half the capacity of cylinders A A′, and are respectively provided with pistons F F′, to the upper faces of which are secured piston-rods *d d′*, the latter having barbed or triangular-shaped heads *e e′* on their upper and free ends. Spiral springs *f f′* encircle the rods *d d′*, the lower ends of said springs resting upon the upper ends of cylinders E E′, while their upper ends are seated against adjustable collars f^2, secured to the rods *d d′*. The spiral springs are of sufficient power to raise and support the weight of the pistons F F′ and their piston-rods. Cylinders A and E are connected by means of a pipe, G, having a stop-cock, *g*, located therein, and cylinders A′ and E′ are connected by a tube, G′, in which is placed a stop-cock, *g′*.

H represents the compression-cylinders, (but one cylinder being shown in the drawings,) which are of the same capacity as cylinders E E′, and in which are located pistons H′) to which are secured piston-rods I I′, the upper ends of which are connected with the pivoted levers I^2 I^3 by means of links *h*. The opposite ends of levers I^2 I^3 are connected with levers K K′ by means of links *i*, and the opposite ends of levers K K′ are pivoted to the rods *d d′*. Compression-cylinders H are connected at their upper ends with exhaust-cylinders A A′ by means of the tubes L L′, in which are placed the check-valves *k k′*, which open outwardly from cylinders A A′.

The pistons in the compression-cylinder are each provided with any desired number of ports, U, which are closed on their under sides by upwardly-closing check-valves T. When the compression-piston rises, air that is admitted to the upper end of the cylinder through tubes L L′ will flow through the ports U in the piston and flowing into the cylinder, thus destroying the vacuum and enabling the piston to rise with little resistance, and also furnish the supply of air for the succeeding compressed charge to be transferred to the working-cylinder. The lower ends of the compression-cylinders are connected with a pair of horizontal cylinders, M, (only one being shown,) in each of which reciprocates a piston, M′. A piston-rod, M^2, attached to piston M′, imparts motion to the crank-shaft M^3 through the connecting-rod M^4.

To the crank-shaft M^3 is secured a fly-wheel,

N, and band-pulley N′. A belt, N², passes around band-pulley N′ and c^2, thereby revolving the latter and any mechanism connected with the shaft F³.

A stud or projection, *w*, is secured to one side of the pulley c^2, and operates the levers O O′ at every revolution of the band-pulley c^2. Lever O′ has attached to its short arm a cord, rope, or chain, *o′*, which passes over pulleys o^2 and o^3, and is attached to one end of the oscillating bar O², which latter is pivoted in a bracket-hanger, O³. Lever O′ is pivoted at one end to the lever O⁴. Cord, rope, or chain *p* is secured to the outer end of lever O⁴, and passes over pulleys *p′* and p^2, and is secured at its opposite end to one end of the bar O². To the opposite ends of the bar O² are pivoted the wedge-shaped weights P P′, which fit between the diverging arms p^3 of the grappling-hooks Q Q′, which latter are of proper form and construction to grasp and hold the barbed heads *e e′*.

By lowering one of the weights P P′ the prongs p^4 of the grappling-hooks are forced apart, thus serving to release the barbed heads *e* or *e′* therefrom.

The rods *d d′* are each provided with a depending rod, R, to the lower end of which is attached a chain, R′, or other flexible connection, which latter is secured at its lower end to one end of the oscillating bar R², the latter being connected with a stop-cock, R³, which regulates the flow of outer air to the cylinder.

To the opposite end of the bar R² is pivoted a link, *r*, which connects with the handle *r′* of the stop-cock *g′*. When the arm R descends it strikes the bar R², and thereby opens the cock R³ and closes the cock *g*, thereby allowing air to enter the cylinder E′, and closing communication between the cylinders E′ and A′.

When outer air is admitted to cylinder E′ the partial vacuum therein is destroyed, thus relieving the piston F′ of the downward pressure of the atmosphere, and allowing the spiral spring L to raise the piston F′ and rod *d′*, and cause the barbed head *c′* to again engage with its grappling-hook. As the arm R reaches its highest limit the chain pulls the outer end of the bar R² upwardly, thereby closing the valve R³ and opening the valve *g*.

In Fig. 3 I have represented a view, in perspective, of the pistons employed in the several cylinders. It is very desirable that some provision be made for preserving a perfect air-tight joint between the several pistons and their cylinders without the necessity of removing the pistons from their cylinders. To accomplish this object I form a spiral groove, S, in the periphery of the piston, the lower end of the groove not extending quite to the lower face of the piston, while the upper end of the groove extends through the upper head of the piston and is closed by a stopper, S′. After the piston has been inserted in the cylinder the stopper S′ is removed, and the spiral groove is then filled with oil, water, mercury, or any fluid or material adapted to maintain an oil-tight joint between the piston and cylinder.

Having thus described the construction and relative arrangement of parts of one form of engine embodying my invention, I will now proceed to give a brief description of its operation.

Assume that the piston B′ has been raised to the top of its cylinder and nearly a perfect vacuum formed in the cylinder A beneath the piston, and also a partial vacuum having been formed in the receiving-cylinder E′ beneath the piston F′. In this condition the atmospheric pressure will exert its downward pressure on piston F, and tend to force it downward to the bottom of its cylinder. As the band-pulley c^2 is revolved in the direction of the arrow, the stud or projection N thereon will strike the long arm of the lever O′, raising it and depressing the short arm thereof, and pulling downward on the cord *o′* and raising one end of the oscillating bar O², thereby causing the wedge-shaped weight P′ to descend and release the barbed head *e′* therefrom, thus allowing the piston F′ and rod *d′* to descend with great force, or with a force equal to the atmospheric pressure exerted upon the top of piston F′ in excess of the atmospheric pressure exerted against the under side of said piston. In other words, if a partial vacuum is formed in cylinder E′, so that the atmosphere will only exert a pressure of five pounds to the square inch on the under side of piston F, the latter will be forced downwardly by a force equal to ten pounds to every square inch of its area.

The power exerted by the piston F in its descent is imparted to the piston of one of the compressing-cylinders through the levers I³ K′, causing the latter to descend and compress the air in the compression-cylinder and supply the compressed air to the working-cylinder of the engine, reciprocating the piston and revolving the crank-shaft. When the piston F′ reaches the lowest point of its downstroke the arm R will strike the oscillating bar R² and close the cock *g*, thereby cutting off all communication between cylinders E′ and A′, and will also open the cock R³ and admit outer air to cylinder E′ below the piston, thereby destroying the vacuum and allow the spiral spring to raise the piston to the upper end to its cylinder and lock the barbed head *e′* in its grappling-hook. As the piston reaches the upper limit of its stroke the chain R′ will close the cock R³ and open cock *g*. As the piston F′ rises the rod *d′*, connected therewith, serves to raise the piston in the compression-cylinder and form a partial vacuum beneath the compression-piston. As stated, the cock *g* will have been opened when the piston F′ and the compression-piston have reached the limit of their upstroke, and hence the air which has entered cylinder E′ to destroy the vacuum therein, will be drawn through the pipe G and lower portion of cylinder A into the compres-

sion-cylinder through pipe L′. In other words, the quantity of outer air which is admitted to the receiving-cylinder to destroy the vacuum therein is transferred to the compression-cylinder and therein compressed for actuating the working-piston of the engine. The air that flows into the compression-cylinders is prevented from flowing back into either of the cylinders A A′ by means of the check-valves K K′ in the pipes L L′.

I have described the operation of only one set of pistons and connecting mechanism; but the other set operates in the same manner, so that a repetition of the description is unnecessary.

One most important result is gained by the employment of the two cylinders A A′ and their pistons B B′, connected outside of the cylinders by the racks and intermediate gear. When one of the pistons, B or B′, is to be raised to form a vacuum or partial vacuum in its cylinder and receiving-cylinder a great expenditure of power is called for to raise the piston; but it will be observed that when one of said pistons is at the bottom of its cylinder the other piston is at the top of its cylinder, and has already formed a partial vacuum in its cylinder, thereby causing the atmosphere-pressure to operate to force it downwardly, and this force is utilized, through the rack-bar and gear-wheel, in raising the other piston. In other words, a partial vacuum is formed alternately in the two cylinders A A′, and hence the atmosphere-pressure exerted upon the piston located in the cylinder in which a vacuum has been created will be nearly sufficient to raise the piston in the other cylinder and form a vacuum therein. The only force to be overcome is that caused by the friction of the parts.

In the foregoing description and in the drawings I have pointed out only one form of engine constructed to operate in accordance with my invention; but I would have it understood that I do not restrict myself to the particular construction and arrangement of parts shown and described, as a great many changes in construction and relative arrangement of parts may be resorted to without avoiding the spirit of my invention.

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

1. An atmospheric engine provided with exhausting-cylinders, receiving-cylinders, and compressing-cylinders, substantially as set forth.

2. In an atmospheric engine, the combination, with the receiving and compression cylinders, of exhausting-cylinders provided with pistons having their piston-rods connected with each other outside of their cylinders, substantially as set forth.

3. In an atmospheric engine, the combination, with the receiving cylinders and pistons, of the exhausting-cylinders and devices for automatically releasing the pistons in the receiving-cylinders when air has been exhausted from the receiving-cylinders, substantially as set forth.

4. In an atmospheric engine, the combination, with the receiving cylinders and pistons, of devices for automatically opening valves or cocks and allowing air to enter said cylinders when the pistons fall to the lower ends of said cylinders, substantially as set forth.

5. In an atmospheric engine, the combination, with the receiving and exhausting cylinders and pipes provided with regulating-cocks connecting said cylinders, of devices for automatically opening and closing said cocks or valves as the receiving-piston rises and falls, substantially as set forth.

6. In an atmospheric engine, the combination, with the receiving cylinders and pistons and compressing cylinders and pistons, of devices connecting the piston-rods, whereby the compressing-pistons are raised simultaneously with the receiving-pistons, substantially as set forth.

7. In an atmospheric engine, the combination, with exhausting-cylinders, of the receiving and compressing cylinders and tubes or pipes extending from the exhausting-cylinders to the upper ends of the compressing-cylinders, substantially as set forth.

8. In an atmospheric engine, the combination, with barbed heads connected with the receiving-piston rods, of grapples and mechanism for automatically releasing said barbed heads, substantially as set forth.

9. In an atmospheric engine, the combination, with the exhausting and receiving cylinders and pistons and compressing and working cylinders and pistons, of connecting-pipes and mechanism for compressing the air in the compression-cylinders by means of atmospheric pressure exerted upon the pistons of the receiving-cylinder, substantially as described.

10. The method of actuating the piston of an engine, consisting, essentially, in forming a vacuum or partial vacuum beneath a piston, and then releasing said piston and utilizing the force of atmospheric pressure exerted thereon in imparting motion to another piston, which compresses air for operating the working-piston of the engine, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 9th day of July, 1880.

EDWIN R. POWELL.

Witnesses:
A. W. BRIGHT,
A. L. LAWRENCE.