S. Chichester,

Compressing Air,

No. 19,981. Patented Apr. 20, 1858.

Fig. 1.

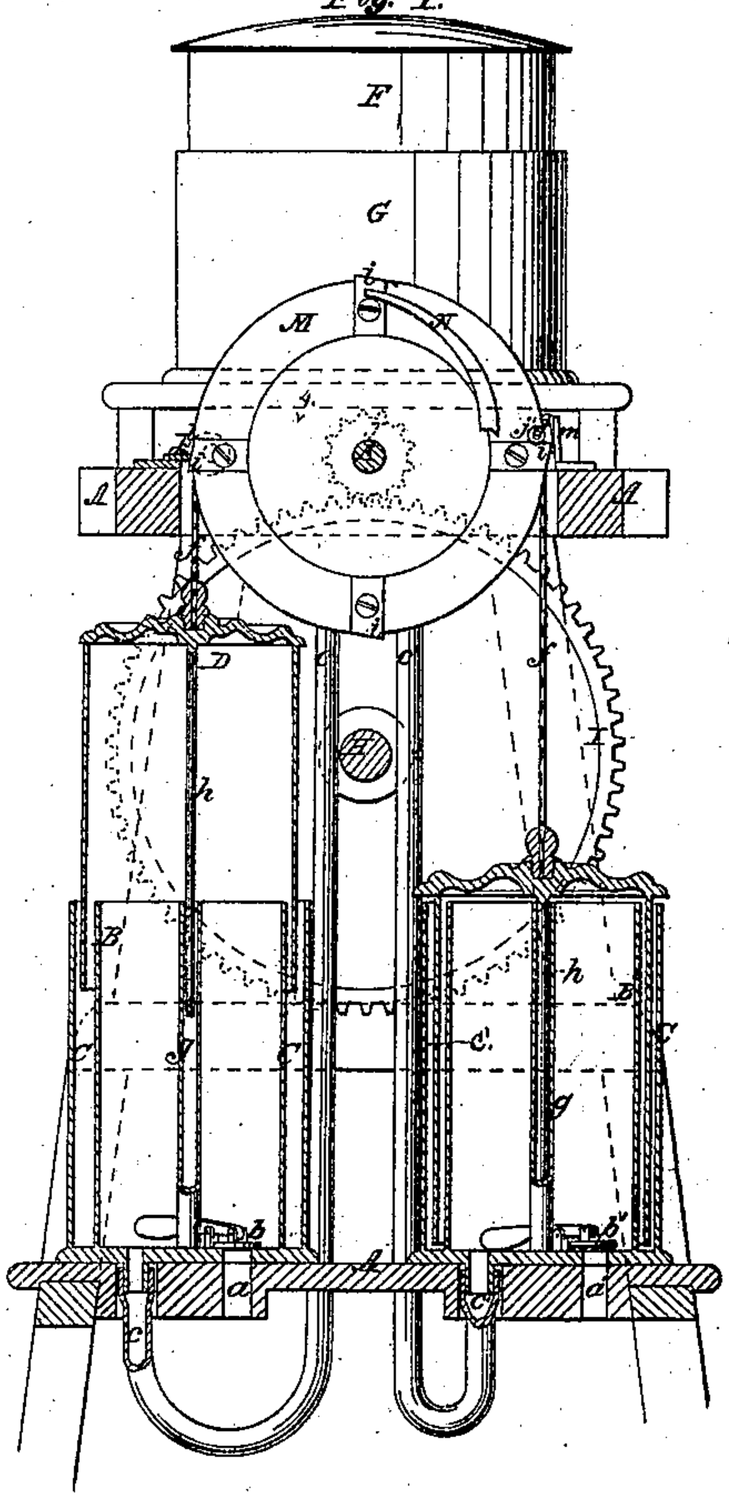


Fig. 2.

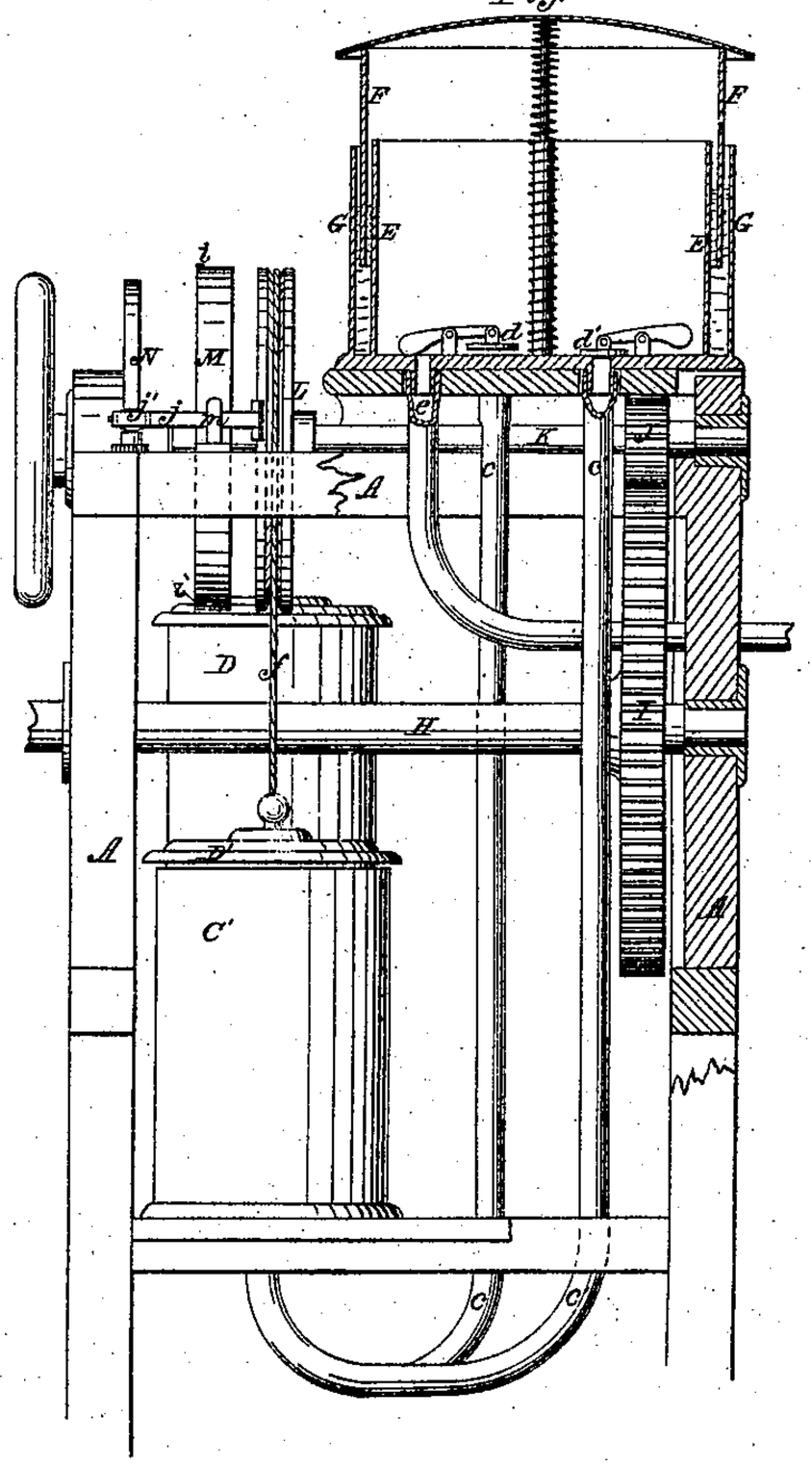
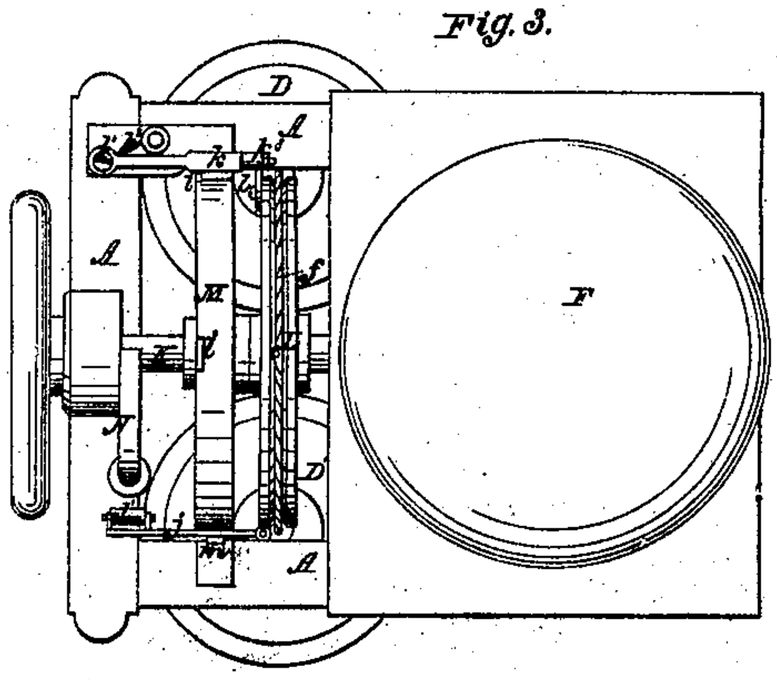


Fig. 3.



UNITED STATES PATENT OFFICE.

SAMUEL CHICHESTER, OF POUGHKEEPSIE, NEW YORK.

COMPOUND AIR-PUMP AND GASOMETER.

Specification forming part of Letters Patent No. **19,981**, dated April 20, 1858.

To all whom it may concern:

Be it known that I, SAMUEL CHICHESTER, of Poughkeepsie, in the county of Dutchess and State of New York, have invented a new and useful Machine for Compressing Air to a Uniform Degree; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figures 1 and 2 are elevations of the machine, taken at right angles to each other and partly in section. Fig. 3 is a plan of the same.

Similar letters of reference indicate corresponding parts in the several figures.

The object of this machine is to obtain from a weight or spring, or other prime mover exerting an unvarying or but little varying force, a supply of air for any purpose, at a pressure above that of the atmosphere, that shall be perfectly uniform notwithstanding any degree of variation in the quantity used. The machine is more especially intended for supplying the necessary quantity of air for passing through and taking up vapor from hydrocarbon liquids for illuminating purposes, particularly the liquid invented by Levi L. Hill, which is now the subject of an application for Letters Patent of the United States.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A A is the framing of the machine.

B B′ are two upright cylinders of equal size, open at the top and surrounded each with an annular cistern, C, containing water.

D D′ are two cylinders open at the bottom, but closed at the top, and fitted to work in the annular cisterns C C, which surround the cylinders B B′. The cylinders B B′ are fitted with small central tubes, *g g*, to receive straight rods *h h*, attached to the heads of the cylinders D D′, for the purpose of guiding the latter cylinders in their motion. The cylinders D D′ constitute pistons to the cylinders B B′, and the water in the cisterns C C constitutes a frictionless packing, and the said cylinders B B′ and pistons D D′ combined constitute two compression-pumps, by which air is collected and compressed and forced into a reservoir, E F G, which is constructed like the pumps, or, in other words, like an ordinary gasometer, of which E is the stationary cylinder, constituting the bottom; F, the floating cylinder or bell, and G the water-cistern.

a a′ are the inlet-openings of the pumps, in the bottoms of the cylinders B B′, fitted with valves *b b′*, which open inward by the pressure of the atmosphere to admit air when the pistons rise, and *c c′* are outlet-pipes leading to the reservoir and fitted with valves *d d′*, arranged within the reservoir, said valves opening toward the reservoir to admit thereunto the air compressed in the pumps by the descent of the pistons.

e is the supply-pipe, by which air is supplied from the reservoir for use.

Midway between the two pumps there is arranged a horizontal shaft, H, which works in fixed bearings in the framing A A and constitutes the main shaft of the machine. This shaft is to have a spring or weight applied to drive it in the same manner as those contrivances are applied to the main arbor of a clock-movement, and it carries a fast spur-gear, I, of large size, which gears with a spur-gear, J, of small size, that is fast upon a horizontal shaft, K, which occupies a position over the middle of the space between the two pumps, where it is fitted to turn in fixed bearings in the frame A A. The shaft K carries a loose pulley, L, to which is secured at one point a cord or chain, *f*, from the two ends of which are suspended the two pump-pistons D D′, the length of the said cord or chain being such that when the head of one of the pistons D D′ is down nearly close to the top of its cylinder B or B′ the other piston is raised up to the greatest height desirable. The circumference of the pulley L is equal to four times the intended length of stroke of the pistons. At one side of the pulley L there is fast upon the shaft K a wheel, M, of a diameter about equal to that of the pulley, the said wheel being furnished with four teeth, *i i*, which project a very little from its periphery, the said teeth being at equal distances apart and each forming a right angle, or nearly so, with the periphery of the wheel on one side, but being beveled off on the other side, as shown in Fig. 1, the rectangular side of the tooth facing in the direction (indicated by an arrow, 4, in Fig. 1) in which the shaft K and wheel M would be caused to rotate by the action of the spring

or weight on the shaft H. The above teeth *i i* serve a double purpose—viz., that of turning the pulley L by engaging with a latch, *j*, which projects sidewise from the said pulley across the face of the wheel and that of stopping the movement of the wheel M, and consequently of the main shaft H, by coming in contact with a stop-piece, *k*, which works on a pin, *k'*, on the top of the framing A A, and has a spring, k^2, applied to it to force it toward the periphery of the wheel.

The latch *j* above mentioned is hinged to the pulley L, so as to be capable of a movement toward and from the periphery of the wheel M, and it has attached to it a roller, *j'*, and there is attached to the framing A A a curved bar, N, of such form that whenever during the rotation of the wheel M in the direction of the arrow 4 one tooth *i* arrives in contact with the stop *k*, the latch *j*, which is engaged by the next tooth behind it, will have been just before brought with its roller *j'* in contact with the said bar and will thereby have been thrown away from the periphery of the wheel and disengaged from the tooth.

An important thing to be observed in the construction of this machine is that the piston D'—that is to say, the one which is raised by the movement of the pulley L with the wheel M and shaft K in the direction of the arrow 4, produced by the movement of the main shaft H—is to be made twice the weight of the other piston, D. To explain the reason for this, I will first state that the force of the main spring or weight which actuates the main shaft is not expended directly in operating the pistons to compress the air; but the compressing force is to be the weight of the pistons themselves, and the main spring or weight is employed to turn the shaft K in a direction to raise the heavier piston, D', so as to permit the descent of the lighter piston, D, by gravitation. When the lighter piston has descended, the latch *j* detaches the loose pulley L from the shaft K and allows the heavier piston to descend by gravitation and draw up the lighter one. In this way the pistons are caused to ascend and descend alternately, and both being of equal area each will exert the same force in the compression of air in the cylinder, as the whole weight of the lighter piston will be effective in its descent; but in the descent of the heavier piston its whole weight, minus the weight of the lighter, will only be effective. With this explanation I will proceed to describe in detail the operation of the machine, first supposing the pistons to be in the condition represented in Figs. 1 and 2—viz., with the heavier piston, D', at the bottom of its stroke. In this condition of the pistons one of the teeth *i* is right opposite the stop-piece *k;* but the said stop-piece is held back to prevent its interfering with the said tooth by a small cam, *l*, which is bolted to one side of the pulley L and which operates against a roller, k^3, attached to the stop-piece; and the opposite tooth is engaged with the latch *j*, which is held close up to the periphery of the wheel M by a stationary plate, *m*, attached to the top of the framing. The shaft K being now entirely under the influence of the main spring or weight, the power of which must be sufficient to raise the whole weight of the heavier piston, besides overcoming the friction of the machine, the shaft K and wheel M turn in the direction of the arrow 4, Fig. 1, and the wheel M carries with it the pulley L, and thus raises the heavier piston, D', and hence, as before stated, permits the descent of the lighter piston, D. When the shaft K, with its wheel and pulley, has completed a quarter-revolution, the latch *j* is moved, by coming in contact with the bar N, far enough out from the wheel M to liberate the pulley L, and almost at the same instant the tooth in advance of that which has been engaged with the latch comes in contact with the stop *k*, and thus causes the stoppage of the shaft K and the whole of the driving mechanism, while the heavier piston, D', descends and carries back the wheel M and raises the lighter piston, D. As the heavier piston, D', completes its descent, the latch *j*, by coming into contact with the plate *m*, is moved in near enough to the wheel M to be caught by the next tooth that it approaches, and almost at the same time the cam *l* comes into operation on the stop *k* and drives it back to liberate the wheel M, which, being thus left entirely under the influence of the main spring or weight and driving-gear, moves again in the direction of the arrow 4 and raises the piston D' again to repeat the above operation, which is repeated again and again till the main spring or weight has run down, or may be repeated for an indefinite period, provided the main spring or weight is wound up before it has entirely run down.

It is obvious that as the force which operates the pistons to effect the compression of the air is the weight of the pistons themselves, and the effective weight of the heavier piston—viz., the difference between its own weight and that of the lighter piston—is equal to that of the lighter piston, the air must be compressed at all times by the pumps to a uniform degree, and the floating cylinder F of the reservoir, being loaded so that the pressure produced by its weight is the same in proportion to its area as is the pressure of the pistons D D', the apparatus can only continue in operation so long as the outlet *e* from the reservoir is open, for it is obvious that as soon as the outlet is closed there will be an equilibrium established between the cylinder containing the descending piston and the reservoir, and as soon as the wheel M is stopped by the stop *k* the machine will stop till the outlet *e* is opened again, and that the velocity at which the machine operates will be governed by the opening of the outlet *e*, or, in other words, by the consumption of air.

The weight of the pistons and bell F of the

reservoir should be proportioned to the minimum pressure likely to be required, as the pressure can be increased at pleasure by placing weights on the pistons and bell, always adding twice as much weight to the piston D′ as to that D and to the bell F in proportion as its horizontal area is to the area of the piston D.

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

A machine composed of a reservoir and two pumps whose pistons, having their weight proportioned as described, are combined with a shaft, K, or its equivalent, to which the power of a spring or weight or other constant first mover is applied by means of a cord or chain, *f*, connecting them with a loose pulley on the said shaft, a wheel, M, fast upon the said shaft, a stop for acting on the said wheel to stop the shaft, and a proper contrivance for engaging the loose pulley with and disengaging it from the shaft, the whole operating substantially as described, for the purpose set forth.

SAML. CHICHESTER.

Witnesses:
W. TUSCH,
W. HAUFF.