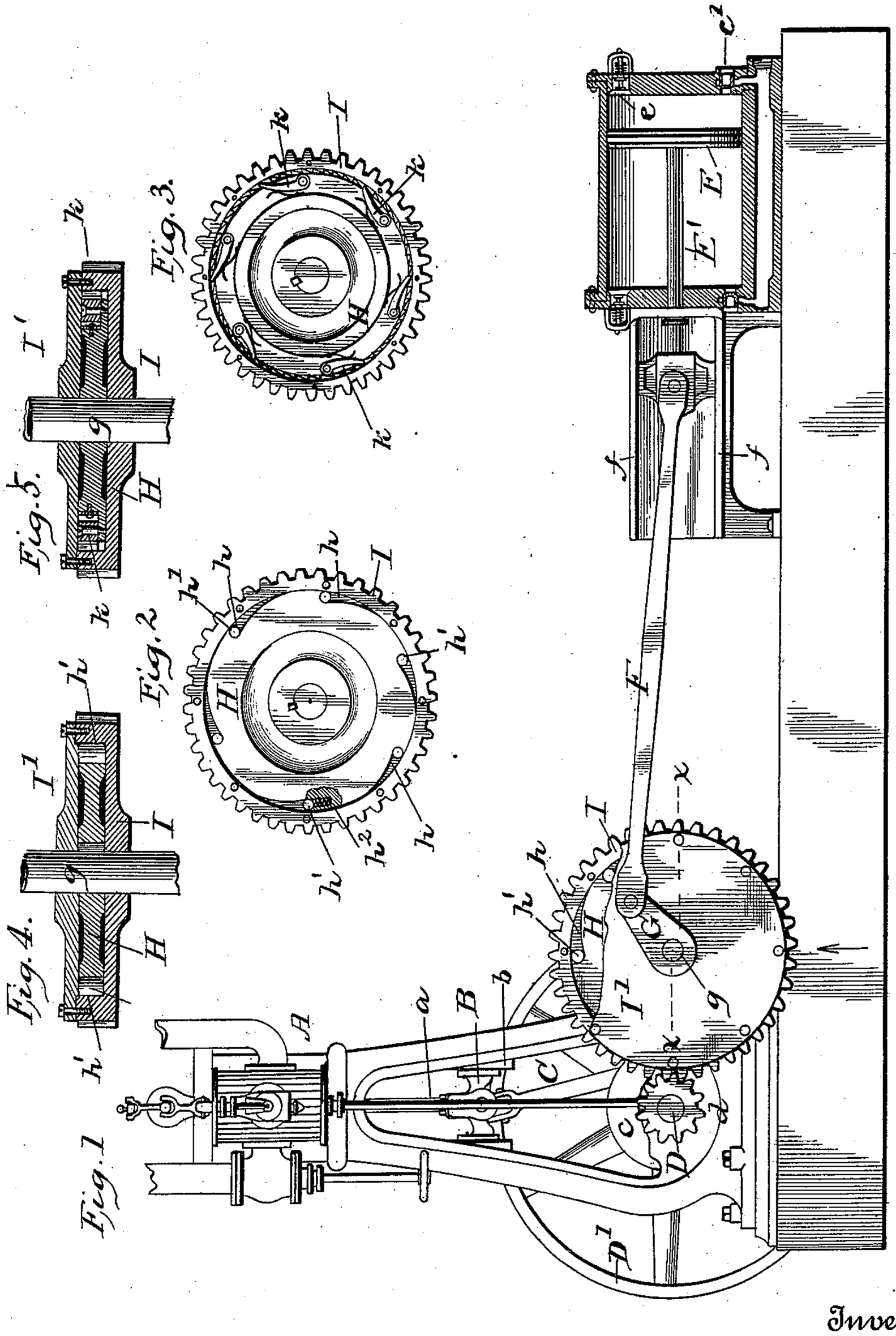
(No Model.)

J. C. GITHENS.

AIR COMPRESSOR.

No. 563,477. Patented July 7, 1896.



Witnesses

L. Wieser.

Louis Wieser

Inventor

Joseph C. Githens

by Wilkinson & Mitchell

Attorney

UNITED STATES PATENT OFFICE.

JOSEPH C. GITHENS, OF RUTHERFORD, NEW JERSEY.

AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 563,477, dated July 7, 1896.

Application filed September 28, 1894. Serial No. 524,375. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH C. GITHENS, a citizen of the United States, residing at Rutherford, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Air-Compressors, of which the following is a specification, reference being had therein to the accompanying drawings.

In the operation of an air or gas compressor of ordinary construction there is a serious loss of both power and time, arising from the fact that the piston of the air-cylinder is doing comparatively little work during a quite large part of its forward and backward stroke when the density of the air is but slightly above the normal. This waste I propose to obviate by so constructing the machine that the piston shall be automatically and independently of the engine moved at a greatly-increased speed during the first half, or thereabout, of its forward and backward stroke and without necessarily using any of the power of the engine during such quick advance of the piston, so that when the power is applied during the latter half, or thereabout, of that advance, it shall be utilized to the best advantage in forcing the dense air into the receiver or reservoir, as will be hereinafter fully explained.

Under one mode which I have adopted for the carrying out of my invention I propose to employ a quick short stroke engine with a spur-pinion on its shaft meshing with a spur-gear of relatively large size on a counter-shaft provided with a crank and pitman connected to the piston of the air-cylinder, the device for connecting the spur-gear to its crank-shaft being those shown in my Patent No. 485,625, and which permit the crank-shaft of the compressor to rotate in a forward direction, alternately in unison with and at a higher speed than the spur-gear. In my said patent, while the crank-pin D moves alternately in unison with and at a higher rate of speed than does the gear *b*, yet the said crank-pin is always connected positively with the driving-shaft H and is driven thereby, whereas in the invention of this patent the piston of the compressor is not always connected with the driving-shaft of the machine, which is the engine-shaft, but is cut loose from the engine-shaft and moves independently thereof part of the time, as will be fully explained.

Figure 1 is a side elevation of an engine and compressor embodying my invention. Fig. 2 is a detail of part of the gearing, illustrating one form of backing-ratchet which I propose to use. Fig. 3 is a modification of Fig. 2. Fig. 4 is a transverse section on line *x x*, Fig. 1, looking in the direction of the arrow on that figure. Fig. 5 is a similar section of the modification indicated in Fig. 3.

In the drawings, A is the cylinder; *a*, the piston-rod; B, the cross-head; *b*, the way or guide; C, the pitman; *c*, the crank-wheel; D, the engine-shaft, and D′ the fly-wheel of an engine of some approved sort which is adapted for the work, but which need not be described in detail.

E is the piston, and E′ the piston-rod of an ordinary air or gas compressor having induction and eduction valves *e e′* at both ends, so that it compresses air or gas at its forward and backward stroke.

In the ordinary operation of an air-compressor its piston does but little work during the first half or so of its stroke, there being during this part of its movement a quite serious loss of both time and power, which waste I propose to obviate by such construction and combination of parts that the piston shall be moved rapidly forward a distance, which may vary somewhat under differing circumstances, but shall always be traveled at a higher rate of speed than would be produced by the engine. In order to attain this end, I combine with the engine-shaft and the air-piston a multipart connection; that is to say, one having two or more members, of which one moves in unison with the engine, another part moving alternately at the same speed and at a speed greater than that of the engine-shaft, one form of such device being shown in Figs. 1 and 2, with a slight modification in Fig. 3.

As I use the compressed air in the clearance-spaces between the piston and the cylinder-heads to produce the accelerated motion on the return stroke of the piston at each end, I think it desirable to so construct the alternating member that it shall be as free as possible to respond to an impulse thus imparted, and without having to overcome fric-

tion or inertia except in a very limited degree, for which reason I have placed the dividing line between the two members as close as convenient to the air-piston.

F is the compressor-pitman, and *f* the way or guide for the cross-head thereof.

G is the compressor-crank, mounted on its crank-shaft *g*. H is a wheel or disk mounted on shaft *g* and provided with a series of cam-shaped recesses *h* in its periphery.

I is a hollow or box-like spur-gear mounted loosely on shaft *g*, and inclosing the wheel or disk H, which is keyed to shaft *g*, the inner face of the rim of the gear being concentric with said disk, so that, under proper conditions, the friction-rollers *h'* will jam between the rim and the cam-walls of the recesses *h* and compel the disk to rotate in unison with the gear I as the latter is being driven by the engine through the pinion *d* on the engine-shaft. In practice I prefer to employ a cap or cover I', secured to the rim of the gear by screws, as indicated in Figs. 1 and 4.

Of course, under such conditions, the air-piston will also move in unison with the engine; but as soon as the compressor has passed either dead-center the compressed air in the clearance-space between the piston and the cylinder-head at that end of the cylinder will impart an accelerated motion to the compressor-piston and that portion of the multipart connection which includes the disk or wheel H, backing-ratchets, shaft *g*, and crank G, the friction-rollers *h'* being released from their grip, so that this increased speed of the air-piston and its connection may be effected without necessitating a corresponding quickened movement of the engine, as will be readily understood without further explanation. Thus it is apparent that the crank G, its shaft *g*, wheel H, and the friction-rollers travel in unison with the gear I and the engine-shaft during part of each stroke of the compressor-piston and travel faster than said gear I and the engine-shaft during another part of each stroke of that compressor-piston, these variations of relative speeds of parts being by turns, so that each is succeeded by that which it succeeds. Thus in this embodiment of my invention the crank G, shaft *g*, wheel H constitute practically the alternating member of the multipart connection between the piston of the air-cylinder and the engine-shaft.

In Fig. 3 I have shown another form of backing-ratchet, where the wheel H carries a series of pawls *k k*, pivoted thereto, and engaging with the toothed inner face of the rim of the spur-gear I; and in order to promote certainty and promptness of action by the rollers I prefer to mount springs h^2 in sockets in the wheel H, (see Fig. 2,) to assist in returning the rollers into engagement with the rim after their grip has been loosened.

The extent of the accelerated movement of the compressor-piston will vary somewhat according to the circumstances, it depending in part upon the density of the air or gas within the clearance-space when the crank passes its dead-center; but under ordinary circumstances it will be sufficient to effect quite a saving of both time and power. It is obvious that the momentum of parts will, during such movement, produce such compression of air in front of the piston E that there will be a tendency to recoil backward and thus lose part of what had been gained; but the ratchets will act as a support, having a new function which is to save what has been gained, because it operates to prevent any return motion—that is to say, backward recoil—of said piston, and it also resumes its old function of a driving device, which will insure that the continued movement of the engine shall promptly carry the piston forward to the completion of its compressing-stroke with practically no cessation of motion nor waste of power. The compressed air in front of the compressor-piston E, which produces such recoil, will serve as a cushion or yielding stop to check the rapid forward movement of the alternating member, and will absorb the momentum which has been acquired by that member and such other parts of the machine as move in unison therewith, whereby such momentum is utilized in doing the work for which the compressor is designed.

I have not shown in detail the construction of the compressor as regards valve mechanism, or air or gas pipe connections, nor any receiver for the compressed air, because such parts may be of any usual or approved kind which are adapted for use in connection with my invention; and it is apparent that while I have explained my improvement as being applied to a double-acting compressor, it may be satisfactorily used in combination with a single-acting cylinder.

By an examination of Fig. 1 it will be seen that as soon as the crank G has passed its dead-center its weight tends to release the backing-ratchets from their grip and permit the alternating member to travel faster than the engine-shaft, these backing-ratchets forming the driving device or connection between the two members.

I am aware that a pump for an oil-well has been so constructed that the engine moved the piston downward with a very slow motion when it was not, of course, performing its function of lifting oil from the well, the quick upward pumping-stroke being effected solely by means of a counterbalancing-weight which had been lifted by the engine while the piston was descending slowly by its own weight, the engine being cut loose from the pump during the entire period while the pump was performing its proper function of lifting oil from the well, whereas in my invention the engine is connected positively to the compressor while the proper function of forcing air under high pressure into the receiver is being performed. So, also, while I prefer to

employ a quick-stroke rapidly-running engine and one of the kinds of backing-ratchets shown in the drawings, yet I do not wish to be limited to any of the details which I have illustrated, because many modifications will readily suggest themselves to any one skilled in the art without going outside of the scope of my improvement.

What I claim is—

1. In an air or gas compressor, the combination with the piston of the air-cylinder, of a continuously-rotating engine-shaft, and a multipart connection between the two of which one member is geared to move in unison with the engine while effecting the greatest compression, another member being geared to move part of the time in unison with the engine-shaft and free to move at a higher rate of speed, these movements alternating with each other sustantially as set forth.

2. In an air or gas compressor, the combination with the piston of the air-cylinder, of a continuously-rotating engine-shaft, and a multipart connection between the two of which one member is geared to move in unison with the engine-shaft, while effecting the greatest compression, another member free to move at a higher rate of speed during that part of the stroke of the air-piston prior to the period of greatest compression of air, substantially as set forth.

3. In an air or gas compressor, the combination with the piston of the air-cylinder, of a continuously-rotating engine-shaft, and a multipart connection between the two comprising a member which is geared to move in unison with the engine-shaft while effecting the greatest compression, another member being geared to move part of the time in unison with the engine-shaft and free to move at a higher rate of speed, these movements alternating with each other and a driving device connecting the two members with each other and adapted to be released by the weight of one of the members, substantially as set forth.

4. In an air or gas compressor, the combination with the piston and air-cylinder having at each end an air-clearance, of a continuously-rotating engine-shaft, and a multipart connection between the two of which one member is geared to move in unison with the engine-shaft while effecting the greatest compression another member being geared to move part of the time in unison with the engine-shaft and free to move at a higher rate of speed, these movements alternating with each other, whereby at each stroke the compressed air in front of the said piston operates as a yielding stop to check the rapid movement of the alternating member, substantially as set forth.

5. In an air or gas compressor, the combination of a continuously-rotating engine-shaft an air-piston geared to the engine-shaft and free to run at an increased speed during part of its travel prior to the period of greatest compression, and means for supporting the air-piston against backward recoil after its increased speed, substantially as set forth.

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

JOSEPH C. GITHENS.

Witnesses:

J. A. GITHENS,

LUTHER SHAFER.