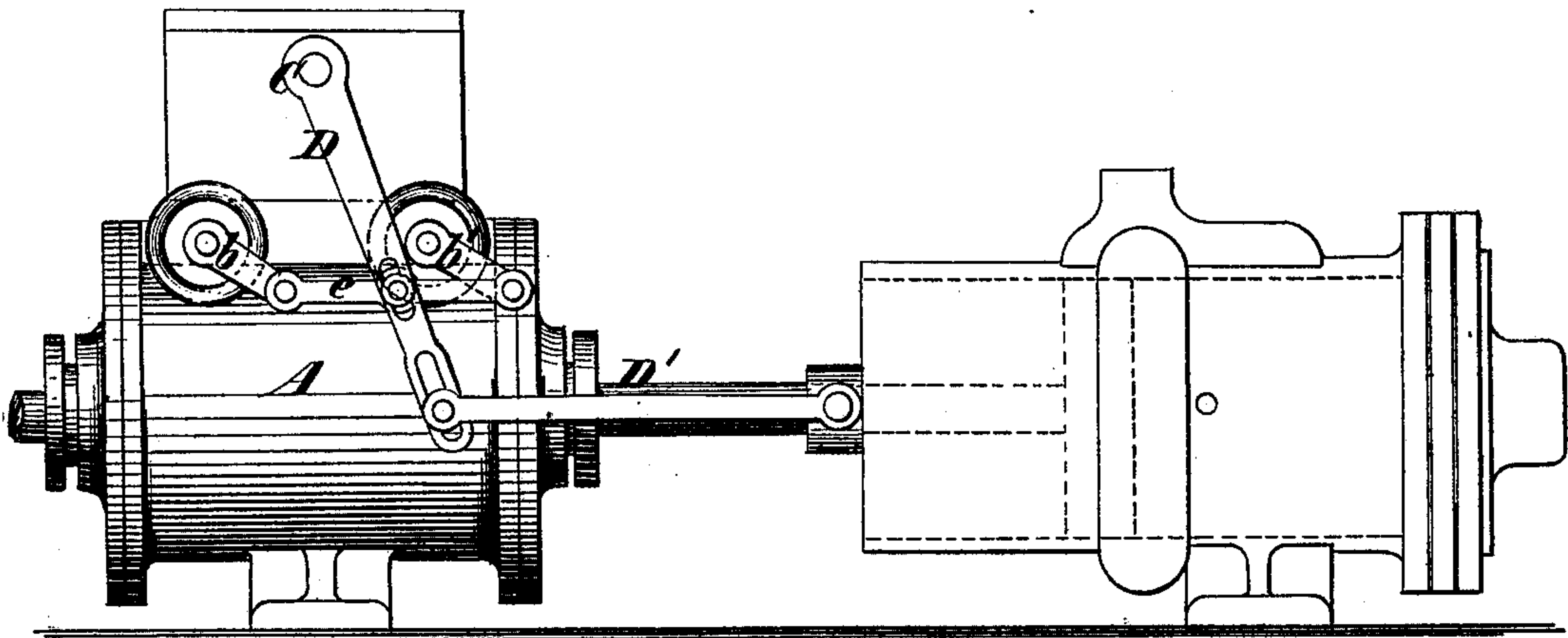


W. F. GARRISON.  
Direct-Acting Engine.

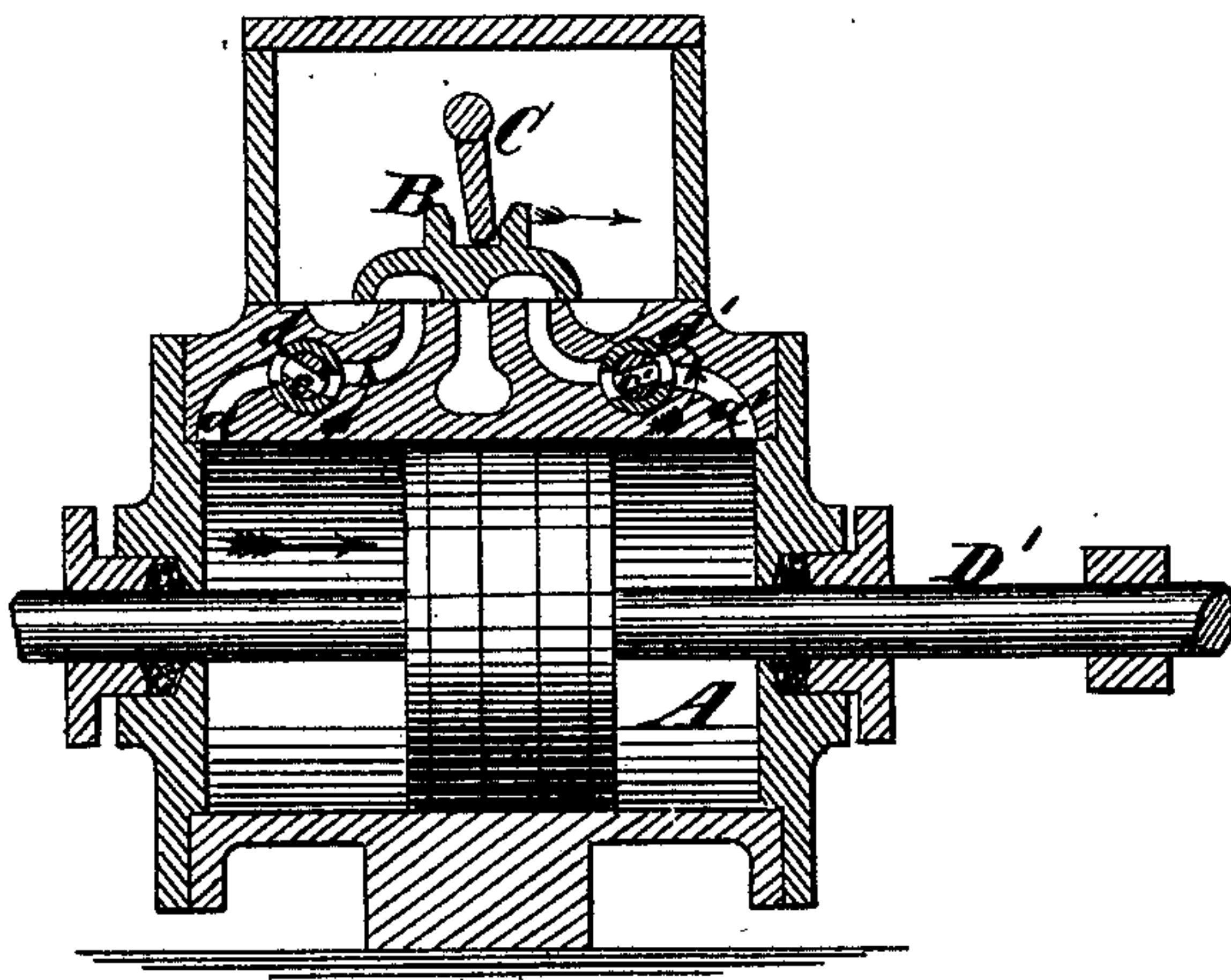
No. 213,890.

Patented April 1, 1879.

*Fig. 1.*



*Fig. 2.*



*Witnesses*

*John Becker*  
*Fred. Hayner*

*Inventor*

*William F. Garrison*  
*by his Attorneys*  
*Brown + Allen*



# UNITED STATES PATENT OFFICE.

WILLIAM F. GARRISON, OF BROOKLYN, NEW YORK.

## IMPROVEMENT IN DIRECT-ACTING ENGINES.

Specification forming part of Letters Patent No. **213,890**, dated April 1, 1879; application filed August 23, 1878.

*To all whom it may concern:*

Be it known that I, WILLIAM F. GARRISON, of the city of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Direct-Acting Engines for Operating Air and Gas Compressors, and for other purposes, of which the following is a description, reference being had to the accompanying drawings, forming part of this specification.

This invention more particularly relates to direct-acting steam-engines in which the resistance to be overcome is a gradually-increasing one from the commencement of the stroke of the engine-piston in either direction to the close thereof—as, for instance, when the engine is used to work an air or gas compressor by the direct connection of the piston of the latter with the piston of the engine.

The object of the invention is to provide, in a simple manner, for the regulation of the supply of steam to the engine-cylinder during the whole of its stroke in such manner that the pressure of steam upon said piston may throughout the whole stroke be approximately in proportion to the gradually-increasing resistance of the work—that is to say, in the application of the invention to driving an air or gas compressor, as hereinbefore referred to, that as the resistance to the compressor-piston increases from the commencement to the termination of its stroke, the pressure of the steam on the engine-piston may be correspondingly increased.

To this end, whether the invention be applied to working an air and gas compressor, as described, or to the performance of any other work in which the resistance to the engine-piston is a gradually-increasing one throughout the stroke of said piston, the invention consists in providing in the steam-passages, between the induction and eduction valve or valves and the ends of the bore of the steam-cylinder, two independent valves, one for each end of the said cylinder, and in so operating the said independent valves that as the piston moves toward either end of the cylinder a contraction of the opening of the independent valve belonging to that end of the cylinder takes place, and as the piston moves

away from either end of the cylinder the said valve is gradually opened wider during such movement, thus insuring a more regular movement of the piston. Such independent valves, it will be observed, operate in a reverse or totally different manner to mere cut-off valves in the steam-passages of an engine for giving an increased supply of steam at starting, and cutting it off at any point in the stroke as the piston advances, which valves, in connection with additional exhaust-passages, have before been used for such purpose, and coupled to control the passages leading to opposite ends of the engine-cylinder; but the independent valves in my invention have a totally different function, do not require separate or additional exhaust-passages, and gradually increase their opening action to the supply as the piston advances, thereby forming what may be termed “increasing-supply” valves.

In the accompanying drawings, Figure 1 is a side elevation of a direct-acting steam-engine having my invention applied, and showing said engine in connection with an air or gas compressor, illustrating the action and utility of the invention; but such compressor forms no part of this invention. Fig. 2 is a longitudinal section of the same.

A is the steam-cylinder, and B the main slide-valve, for induction and eduction of the steam to and from opposite ends of the said cylinder through the passages *a a'*. This valve may be of any well-known or suitable construction, the ports in its seat communicating with the passages *a a'*, being laid out and arranged to suit the construction of the valve, which may be also operated in any well-known or suitable manner, either by the aid of a supplementary valve and piston, or of any other means actuated by the rock-shaft C, whose arm D derives motion from the piston-rod D'.

*c c'* are the independent valves, which constitute the principal feature of the invention, arranged in the passages *a a'*, between the main induction and eduction valve A and the bore of the cylinder. These valves *c c'* are represented of cock-like construction, consisting of plugs having transverse passages through them, and fitted into seats *d d'*, which intersect the passages *a a'*. The spindles of the



said valves are furnished with arms *b b'*, which are both connected, by a rod, *e*, with the operating-arm *D* of the induction and eduction valve-gear, as shown in Fig. 1, in such manner that as the piston moves in either direction the valve, *c* or *c'*, belonging to that end of the cylinder from which the piston is moving will have an opening movement, and the other one will have a closing movement, the first-mentioned valve being opened wide as or only a little before the piston completes its stroke, and the last-mentioned being at the same time nearly closed, or very much contracting the opening of its passage. This operation of the valves will give only a small supply of steam and a light pressure on the piston as the latter commences its stroke, and the resistance to the movement of the compressor-piston, or of the work whatever that may be, is slight, and will give a gradually-increasing supply of steam and increasing pressure as the stroke of the piston progresses and the resistance to the compression of the air, thus obtaining a more regular movement of the pistons. This operation is independent of the action of the induction and eduction valve or valves, which act in the usual way, and the said operation is effected without cramping the exhaust, the valves *c c'* being wide open when the exhaust commences, and contracted prior to their admission of steam. These valves *c c'*, by their action, form the hereinbefore-referred-to increasing-supply valves.

In order to provide for giving a greater or less supply of steam throughout the stroke of the piston, the valve-seats *d d'* are not formed directly in the cylinder *A* and passages *a a'*, but consist, as shown in Fig. 2, of separate tubes, having ports in them corresponding in

size with the passages *a a'*. By adjusting these tubular seats so as to bring their ports directly opposite the passages *a a'*, the fullest supply of steam is obtained, and by turning or adjusting the said seats more or less out of line with the passages the latter are more or less contracted to more or less reduce the supply of steam, as may be desired, according to the work to be performed.

It is obvious that the invention may be applied to an engine for working a vacuum-pump with the same advantages as to an engine for working an air or gas compressor, inasmuch as in both cases the resistance to the engine-piston throughout its stroke is a gradually-increasing one.

I claim—

1. In combination with the cylinder, induction and eduction valve or valves, and valve-gear of a direct-acting steam-engine, independent increasing-supply valves, arranged, substantially as herein described, within the passages between said induction and eduction valve or valves and the bore of the cylinder, and operated by the valve-gear to produce the contraction of the opening of said passages prior to the admission of steam to the cylinder, and the wider opening of said passages as the stroke of the piston produced by such admission proceeds, substantially as herein set forth.

2. The adjustable tubular valve-seats *d d'*, having ports in their sides, in combination with the valves *c c'* and the steam ways or passages *a a'* of the engine, constructed and arranged for operation essentially as described.

WM. F. GARRISON.

Witnesses:

HENRY T. BROWN,  
T. J. KEANE.