

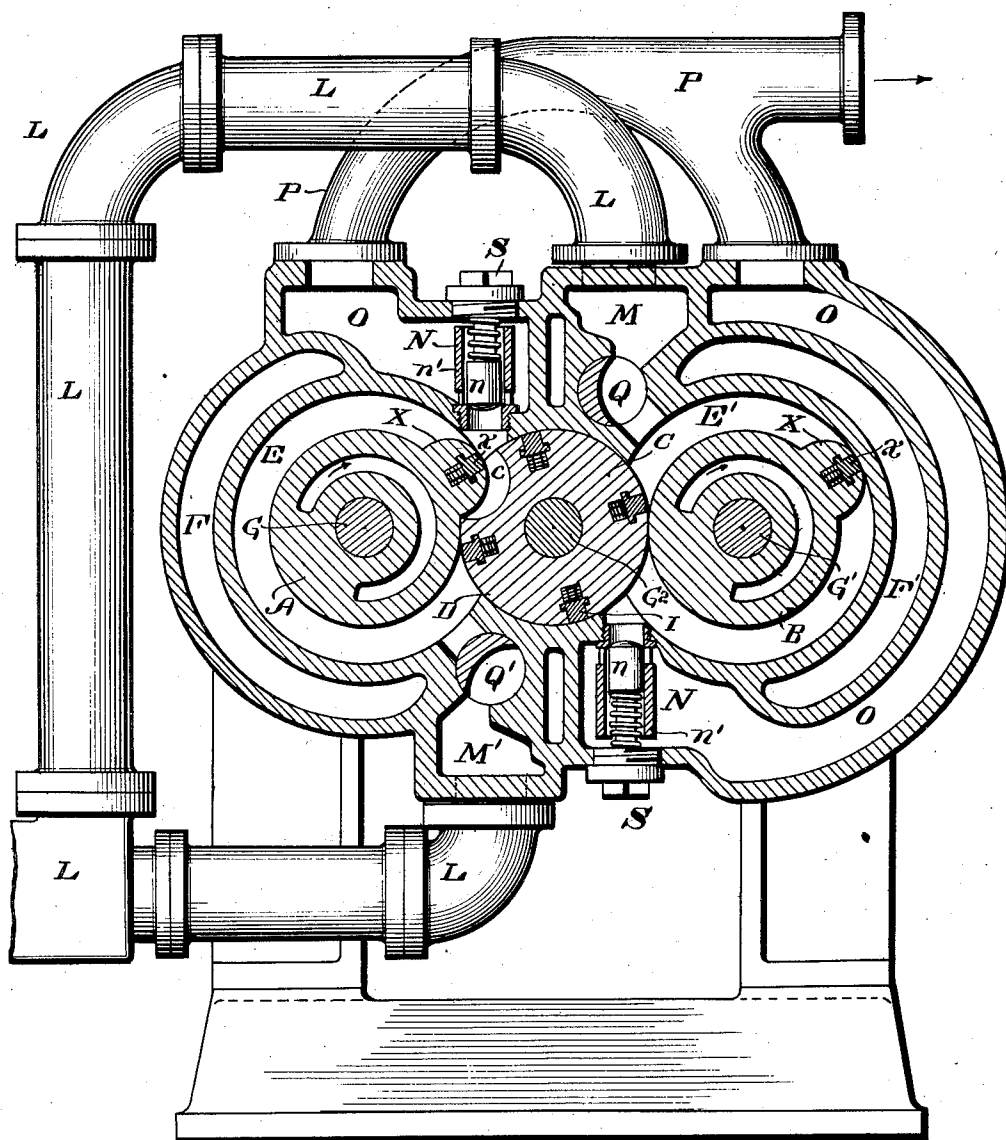
V. J. DIEFENDERFER.
AIR COMPRESSOR.
APPLICATION FILED OCT. 9, 1911.

1,037,455.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



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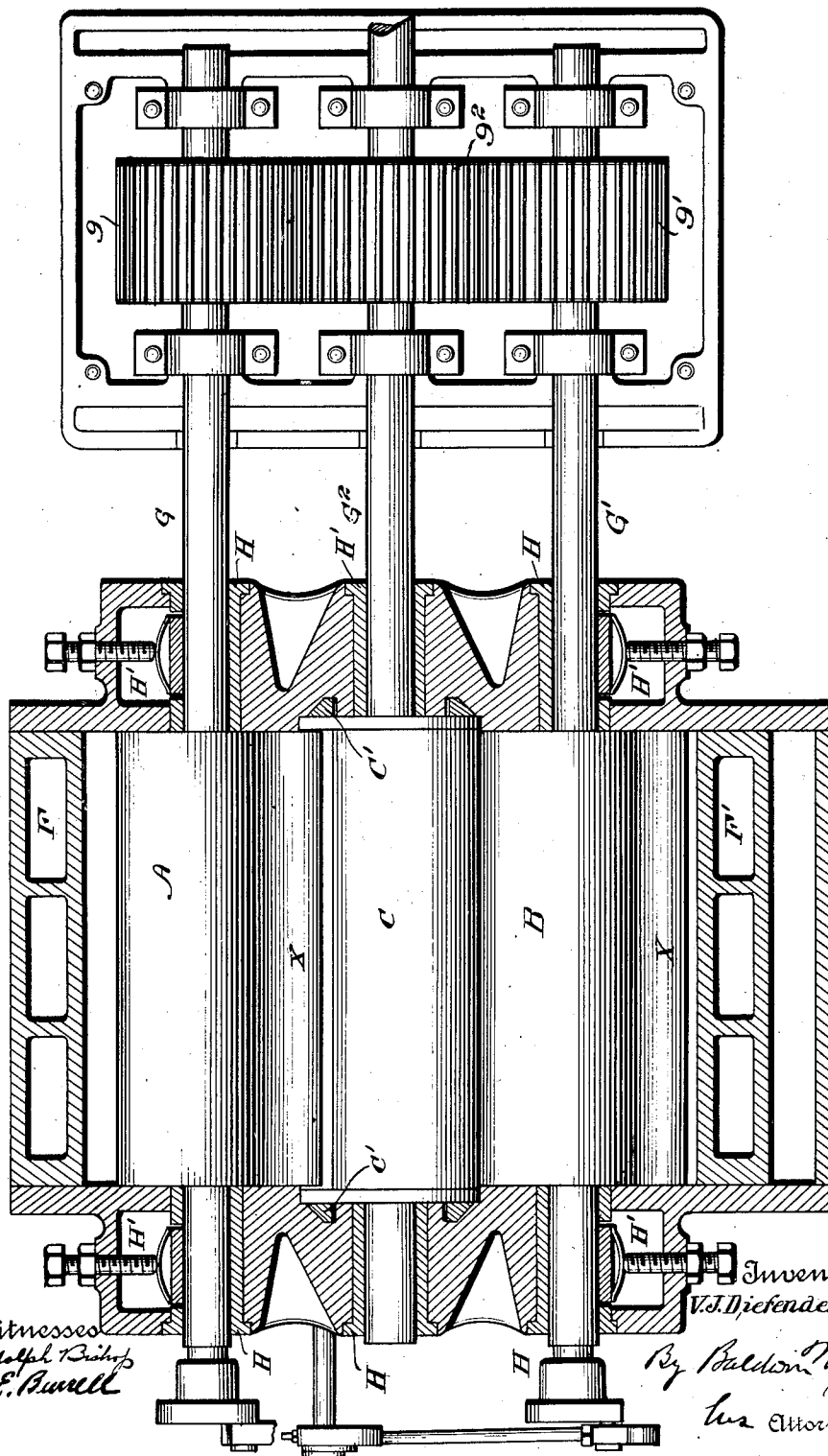
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4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

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Fig. 3.

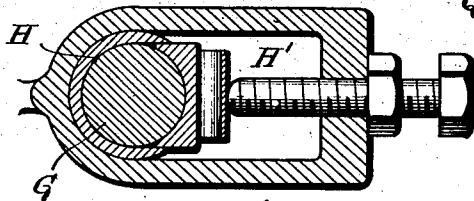
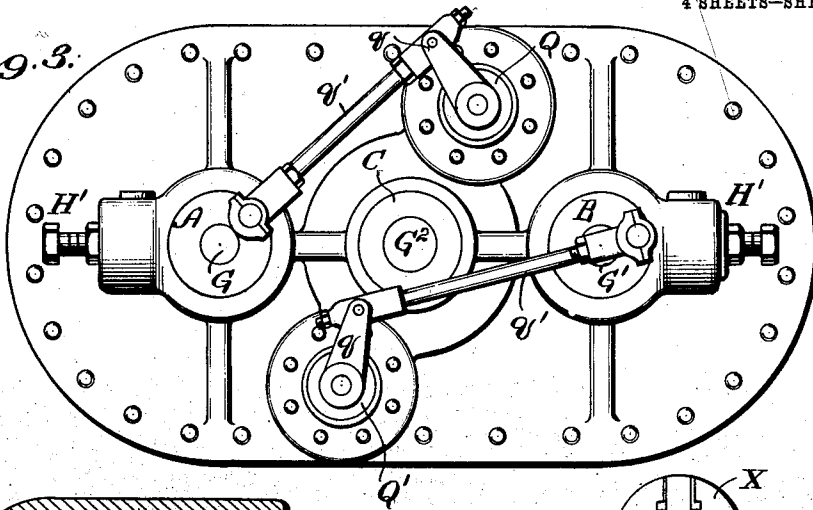


Fig. 4.

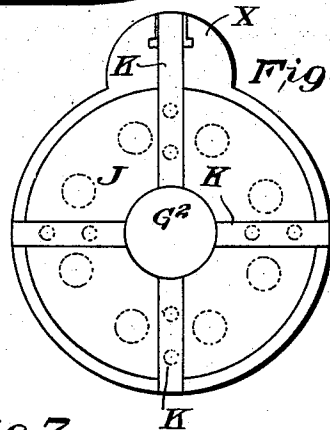


Fig. 6.

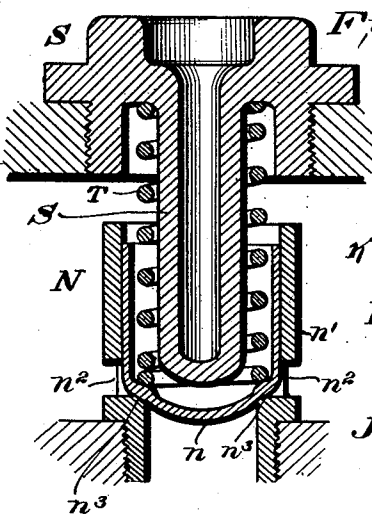


Fig. 5.

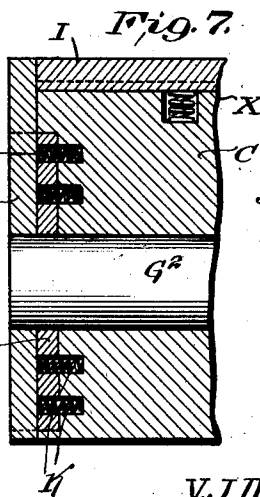


Fig. 7.

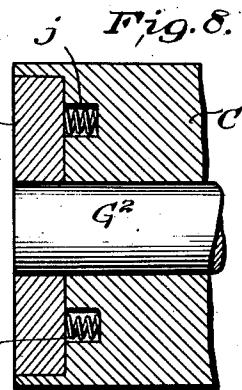


Fig. 8.

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Fig. 9.

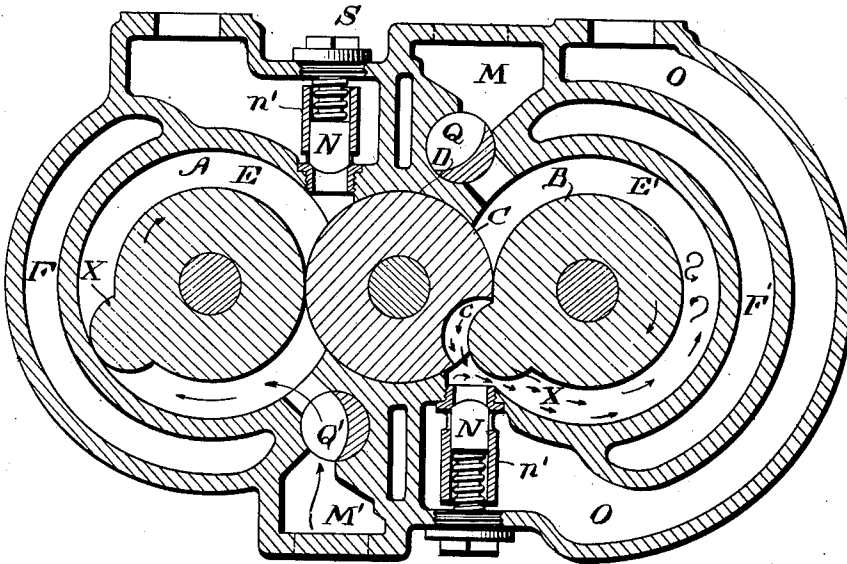
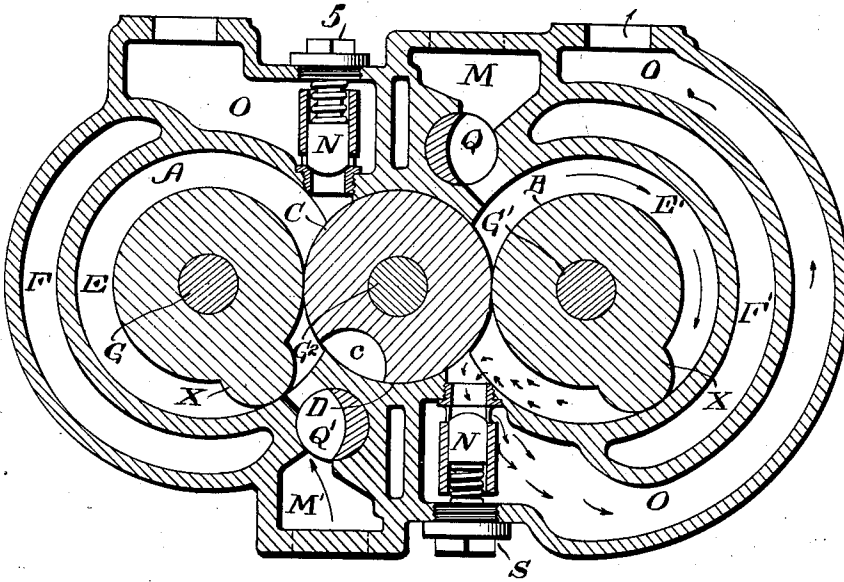


Fig. 10.

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UNITED STATES PATENT OFFICE.

VICTOR J. DIEFENDERFER, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR OF ONE-HALF
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AIR-COMPRESSOR.

1,037,455.

Specification of Letters Patent.

Patented Sept. 3, 1912.

Application filed October 9, 1911. Serial No. 653,490.

To all whom it may concern:

Be it known that I, VICTOR J. DIEFENDERFER, a citizen of the United States, residing in Allentown, in the county of Lehigh and State of Pennsylvania, have invented certain new and useful Improvements in Air-Compressors, of which the following is a specification.

My invention relates to air compressors of the class in which air is drawn into an annular chamber by a rotary piston-carrying member usually called a rotor and is compressed and expelled through suitable valve mechanism into a reservoir, pipe line or other receptacle, or into the working chamber of another machine for further use.

The object of my invention is to so improve machines of this class that two or more compressing rotors may operate with an intermediate rotor or abutment to compress air or other like fluid in such manner as to balance the machine and to save and further compress such of the compressed air as does not escape through the valves, thus causing the discharge valve to open earlier and so increase the volumetric efficiency of the machine.

In carrying out my invention, I employ three rotors of the same size and arranged horizontally in line with each other. The two outside rotors which carry pistons operate in chambers into which the air is drawn and compressed, and from which it is expelled through suitable valves. The intermediate rotor serves as an abutment and is recessed to receive the pistons of the other two rotors at proper times during their rotation.

The air (or other fluid to be compressed) enters the compression chambers of the two piston-carrying rotors through valves which are opened as the pistons pass the air inlets and remain open until the pistons have drawn in behind them the required amount of air and compressed in front of them air previously induced. Most of the air thus compressed passes through properly weighted valves, but some of the compressed air which does not pass through the valves expands back into the compression chambers at which times the inlet valves are closed and remain so closed until the pistons have passed them when they are again opened. In this way as the compression chambers are supplied with air under pressure just after

the pistons pass the outlet valves the necessary degree of pressure to open the outlet valves is attained earlier than would be the case if the pistons operated on air at atmospheric pressure during the compression stroke so that the volumetric efficiency of the apparatus is materially increased.

In the accompanying drawings:—Figure 1 is a view, partly in end elevation and partly in vertical section, of an air compressing apparatus embodying my improvements. Fig. 2 shows a longitudinal central section thereof. Fig. 3 is an end view of the mechanism for operating the inlet valves. Fig. 4 is a detail sectional view, on an enlarged scale of the means for adjusting the bearings of the piston-carrying rotor shafts to compensate for wear. Fig. 5 is a detail sectional view, on an enlarged scale, of one of the outlet valves. Fig. 6 is an end view of one of the piston-carrying rotors. Figs. 7 and 8 are sectional views, illustrating the manner in which the rotors are packed. Figs. 9 and 10 are sectional views somewhat diagrammatic and with some parts omitted, illustrating the operation of the rotors.

I preferably employ three rotors, A, B and C, of the same length and diameter and arranged side by side in the same horizontal line. The outer rotors A and B carry pistons X while the intermediate rotor C, called the abutment rotor, is formed with a recess *c* adapted to receive the pistons. The casing is suitably constructed to receive the rotors. The intermediate or abutment rotor C operates in a chamber D between two chambers E, E' in which the piston-carrying rotors work and which chambers are surrounded by jackets F, F' through which water or other cooling medium may be circulated. The shafts G, G', G² of the rotors extend through bearing sleeves H in the heads of the casing and are geared together at *g, g', g²* so as to revolve at the same speed. The bearing sleeves H of the outside rotors are provided with adjustable parts H' to compensate for wear and to hold the outside rotors in close contact with the intermediate rotor.

The abutment rotor is provided with radially movable spring pressed packing strips I to provide an air tight connection between the periphery of the rotor and the walls of the chamber D and it also has packing at its ends for a similar purpose. Preferably

these end packings are of the kind shown in Figs. 6, 7 and 8 where the end of the rotor is shown as being recessed and receiving a circular plate J pressed outwardly by springs *j*, such plate J being formed with radial recesses which receive the radial packing strips K pressed outwardly by springs *k*. Each end of each piston-carrying rotor may be packed in the same way. The ends of the abutment rotor C may be suitably packed, as indicated at C', in Fig. 2.

Air is admitted to the compression chambers E, E' through air conduits L which connect with air inlet chambers M, M' in the casing, and the compressed air passes from the compression chambers through puppet valves N and into passages O in the casing which communicate with a compressed air conveying pipe P. The pistons X are provided with radially moving spring pressed packing strips *x* which prevent air from passing by them as is usual in this class of machines.

Between the air inlets M, M' and compression chambers E, E' are interposed inlet valves Q, Q'. These are preferably of the semi-rotary or rocking type and are constructed and operated in any suitable way but preferably in the manner shown in Fig. 3 where each valve is provided with an arm *q* connected by a rod *q'* with one of the outside or piston-carrying rotors. Each outlet valve N is preferably of the construction indicated and shown on an enlarged scale in Fig. 5. The valve proper *n* is cup-shaped and reciprocates in a cylindrical casing *n'* having lateral ports *n*² and a valve seat at *n*³, which valve casing *n'* has a threaded connection with the rotor casing near the abutment rotor C and which casing *n'* is in line with a screw plug S having a stem S' which projects into the valve *n* and is surrounded by a spring T which normally presses the valve toward its seat. The tension of the spring may be adjusted so as to weight the valve to the proper extent. The valve is of course subjected to back pressure and is not opened until the pressure in the compression chamber exceeds that in the reservoir or the compressed air conduits.

The operation of the compression apparatus is most clearly shown in Figs. 9 and 10 in which, as before stated, some parts are omitted as being unnecessary to illustrate the operation of the apparatus. When the rotor A is in the position shown in Fig. 9, the inlet valve M' is open and as the rotor moves in the direction indicated by the arrow air is drawn in by the piston X in the manner shown in the left-hand side of Fig. 10. When the piston X of the rotor A has moved closer to the abutment rotor or reaches a position corresponding to that of the piston of the rotor B in Fig. 9, the air

in front of the piston will be compressed to such an extent as to open the discharge valve N as indicated at the right-hand side of Fig. 9, and most of the compressed air will pass out as indicated by the longer arrows in Fig. 9. The inlet valve at this time is open. When, however, the piston reaches the position corresponding with the position of the piston B in Fig. 10, that is after the piston has withdrawn from the curved wall of the annular compression chamber and is passing the outlet valve, the outlet valve will close as the internal pressure is reduced, but it will be observed that there is considerable compressed air remaining between the piston and the abutment rotor, some of which is contained within the recess of the abutment rotor. This compressed air expands in the manner indicated in Fig. 10 and passes into the compression chamber in rear of the piston. At the same time the inlet valve is closed, as indicated, but as soon as the piston passes the inlet opening, that is, when it reaches the position shown at the left-hand side of Fig. 9, the inlet valve is opened and air is drawn in behind the piston which is, with the compressed air before referred to, compressed by the piston during its next revolution. In other words, the air that is drawn in during one revolution of the piston is mixed with compressed air before the piston operates to compress it. In this way the volumetric efficiency of the machine is materially increased as the expansion of the compressed air back into the compression chamber raises the compression in this way in advance of the piston so that the discharge valve will be opened somewhat earlier. It will be observed by reference to Fig. 2 that the piston on the left-hand side is not doing any work while the piston on the opposite side is compressing but as the rotor continues to move the piston on the right-hand side will enter the recess *c* and will not then be compressing while the piston on the left-hand side will be doing the work. In this way there is a balancing of the compressing members and less power is required to operate them.

As before stated this apparatus may be employed to compress not only air but other fluids, and so far as part of my invention is concerned, I may employ two rotors instead of three.

It will be observed that the discharge valves are so weighted either by springs, back pressure, or the like, that they cannot be opened until a certain pressure has been produced by the pistons. It will also be observed, referring especially to Fig. 10, that the pistons are of such form that when a piston commences to enter the recess *c*, the compressed air can escape therefrom and can continue to so escape until the piston has practically filled the recess, so that

heavy pressure within the recess is not produced. This is effected by so arranging the mechanism that the outer periphery or surface of the piston does not touch the interior wall of the recess and does not come in close proximity thereto until the piston has fully entered the recess and the latter is practically filled.

I claim as my invention:

10 1. An air compressor, comprising two rotors each carrying a single piston, annular compression chambers in which the pistons operate, an intermediate or abutment rotor in rolling contact with the other two
15 and having a recess to receive a piston at each half revolution of the abutment, inlet and discharge valves for the compression chambers, means for operating the admission valves to admit a compressible fluid
20 to the compressing chambers, and means for relieving the pressure on the advance side of the piston in one chamber as the pressure on the advance side of the piston in the other chamber increases, and means
25 for at this time holding the discharge valve and the inlet valve of one of the chambers closed.

2. An air compressor, comprising a piston-carrying rotor, an annular compressing
30 chamber in which the piston operates, an abutment rotor having a recess to receive the piston at each revolution, an inlet valve for the compression chamber, a discharge valve therefor, means for opening the inlet
35 valve to admit a compressible fluid behind the piston as it passes and for closing it

when the piston is passing the discharge valve whereby the compressed fluid between the piston and the abutment may pass back behind the piston and enter the compression chamber while the inlet valve is closed, 40 and means for at this time closing the discharge valve to thus supply fluid under pressure to the compression chamber in advance of the piston on its working stroke. 45

3. An air compressor, comprising two rotors, each carrying a single piston, annular compression chambers in which the pistons rotate, an intermediate or abutment rotor in rolling contact with the other two 50 and having a recess to receive a piston at each half revolution of the abutment, inlet and discharge valves for the compression chambers, means for operating the inlet valves to admit compressible fluid to the compression chambers behind the pistons on 55 their compression strokes, means for closing the discharge valves as the pistons approach the ends of their compression strokes and while said pistons are passing the discharge outlets, and means for at this time 60 closing the inlet valves whereby fluid under pressure is made to enter and be confined in the compression chambers to be further compressed as the pistons proceed and perform their compression strokes. 65

In testimony whereof, I have hereunto subscribed my name.

VICTOR J. DIEFENDERFER.

Witnesses:

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E. E. EARICH.