G. B. PETSCHE.

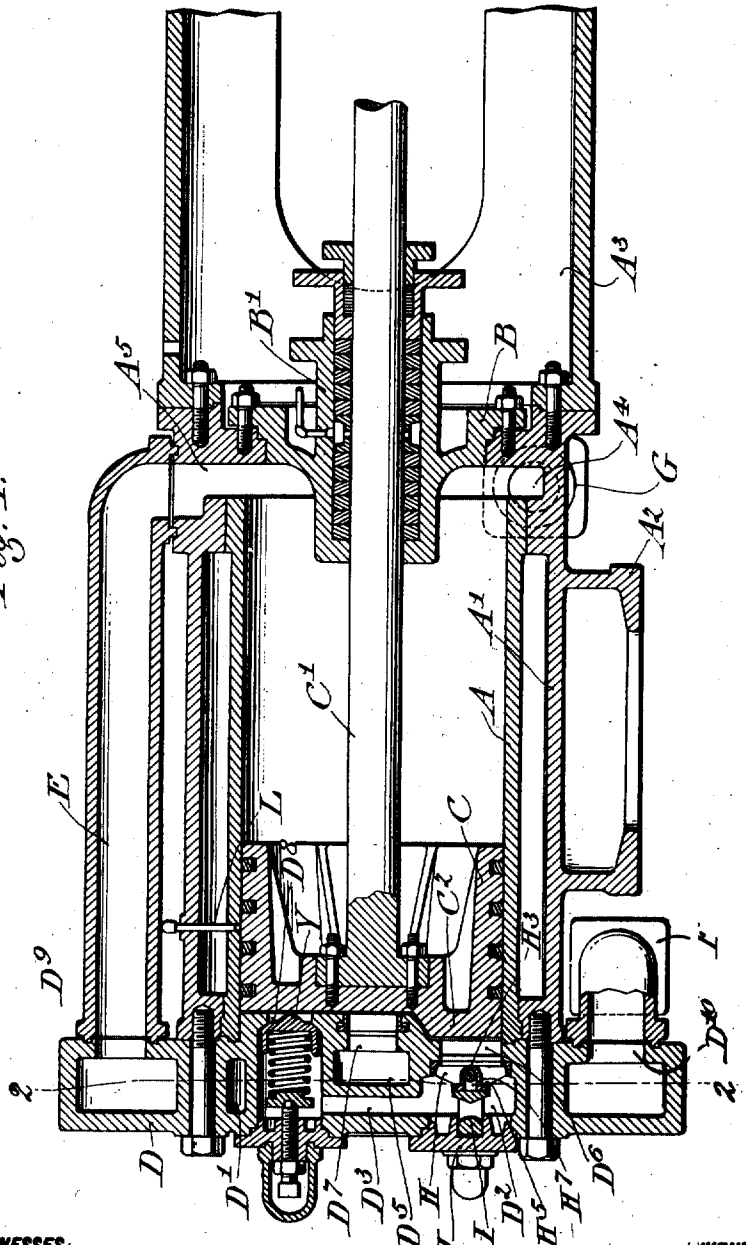
BLOWING ENGINE OR COMPRESSOR.

APPLICATION FILED MAR. 17, 1910.

1,008,559. **Patented Nov. 14, 1911.**

3 SHEETS—SHEET 1.

Fig. 1.



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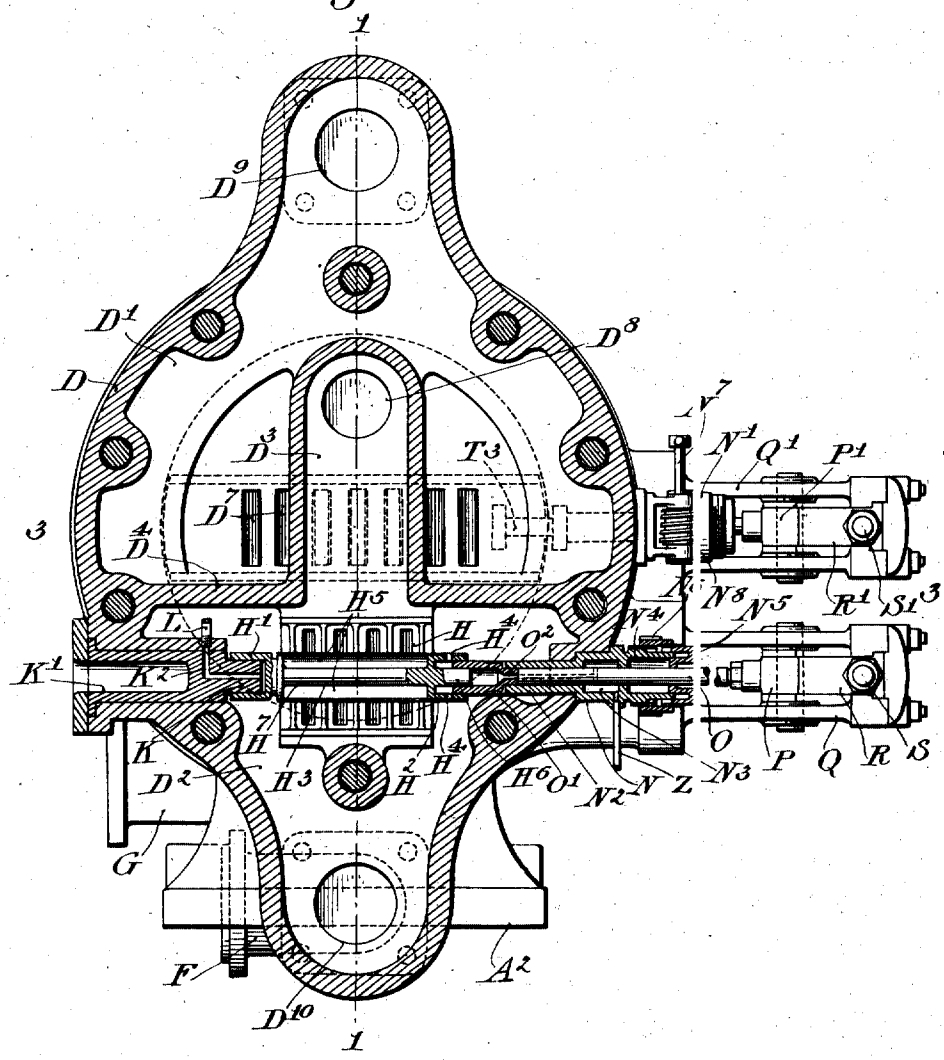
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

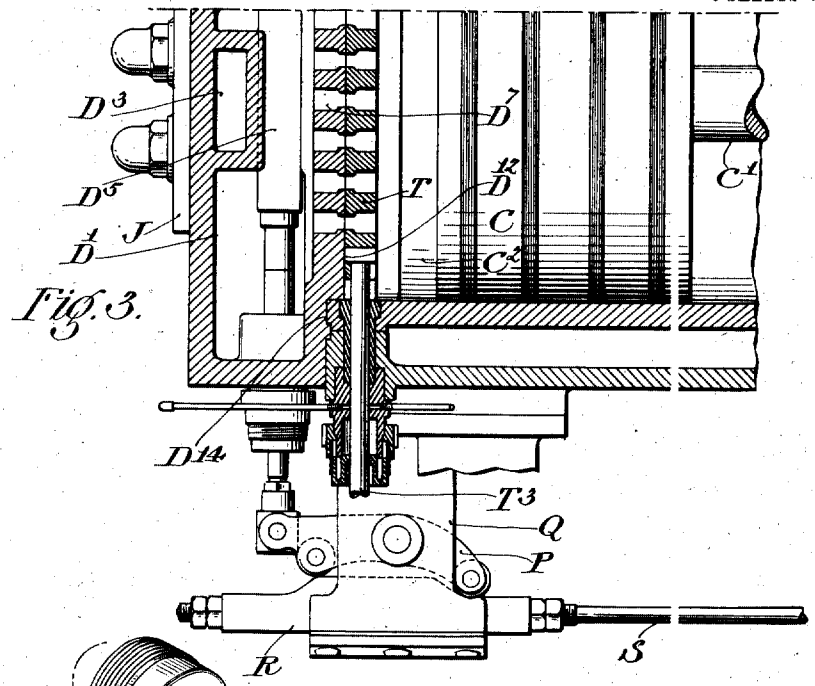


Fig. 3.

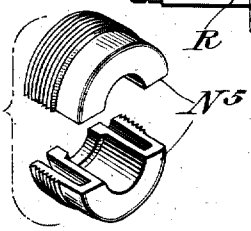
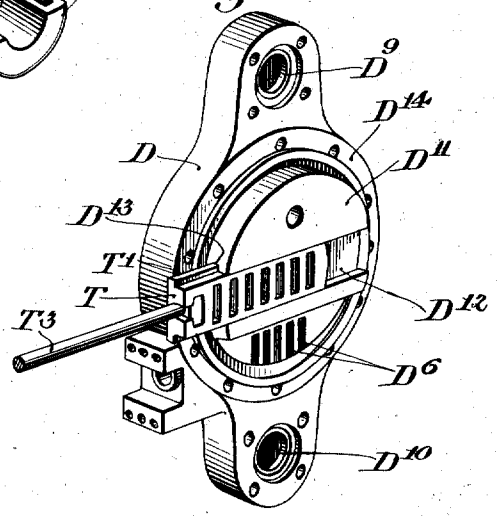


Fig. 5.

Fig. 4.



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BLOWING-ENGINE OR COMPRESSOR.

1,008,559. Specification of Letters Patent. Patented Nov. 14, 1911.

Application filed March 17, 1910. Serial No. 550,015.

To all whom it may concern:

Be it known that I, GUSTAV B. PETSCHE, a citizen of the United States of America, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Blowing-Engines or Compressors, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My present invention relates to blowing engines or compressors of the kind in which air or other gaseous fluid is put under pressure by a reciprocating piston working in a cylinder, and the invention is primarily designed for use in engines of this character such as ammonia compressors designed for putting the gaseous fluid under pressure substantially higher than the pressure to which air is raised in the ordinary blowing engine for supplying blast furnaces.

The general object of the invention is to improve engines of the character specified, particularly in relation to the disposition of the ports and passages through which the fluid to be compressed is admitted to the compressing cylinder and after being compressed is conveyed away from the compressing cylinder, and in the disposition of the valves controlling the admission to and discharge from the compressing cylinder and the means employed for operating the valve controlling the discharge from the compressing cylinder.

More specifically, one object of the invention is the provision of an improved valve seat construction.

Another specific object of the invention is the provision of a gridiron sliding outlet valve actuating means including a piston and cylinder arrangement for automatically opening the valve when the pressure in the compressing cylinder reaches a predetermined value relative to that in the receiving chamber, and means for positively closing the valve when the compressing piston reaches the end of the stroke, in accordance with a known plan, characterized by the provisions for avoiding likelihood of interference with the operation of the valve, by the large, and more or less uncertain, friction between the portion of the valve operating mechanism which extends through the wall of the engine and the stuffing box therefor, which must be employed to avoid leakage with the high pressure in the receiving chamber.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it, reference may be had to the accompanying drawings and descriptive matter in which I have illustrated and described one of the forms in which the invention may be embodied.

Of the drawings, Figure 1 is a partial sectional elevation of an engine, the section being taken on the line 1—1 of Fig. 2. Fig. 2 is a section on the line 2—2 of Fig. 1. Fig. 3 is a partial sectional plan on the line 3—3 of Fig. 2. Fig. 4 is a perspective view of one head of the compressing cylinder, and Fig. 5 is a perspective view of a portion of a stuffing box construction which may be employed.

In the drawings, A represents the inner wall and A′ the outer wall of the compressing cylinder proper, the walls A and A′ being separated by the usual water jacket space.

A^2 represents a pedestal or supporting base for the compressing cylinder, and A^3 the strut like frame portion by which one end of the compressing cylinder is connected to the frame of the driving engine not shown.

C represents the compressing piston, C′ the rod therefor, and B′ the stuffing box, in the end wall or head B of the cylinder, through which the stem C′ passes.

D represents the front head or end member of the compressing cylinder.

In the construction illustrated, the engine is single acting, and the inlet and outlet ports of the compressing cylinder and the seats for the valves controlling these ports

are all formed in the end member or head D. As shown best in Fig. 2, the end member D is hollow and is divided into an inlet chamber D′ and an outlet chamber D^2 by a partition D^4. The wall D^4 has a central U shaped portion surrounding an upward extension D^3 of the outlet chamber D^2, the purpose of which is to provide communication between the outlet chamber proper and the relief or snifting port D^8 controlled by the puppet relief or shifting valve Y. The snifting port D^8 is located above the inlet ports D^7 which are vertically elongated and arranged in a diametrically extending horizontal row. The outlet ports D^6 are vertically elongated and arranged in a horizontal row below the row of inlet ports and of course may be, and are shown as being, smaller in number and aggregate cross section than the inlet ports.

As shown clearly in Figs. 1 and 3, a channel or passageway D^5, in communication at its ends with, and really forming a portion of, the inlet chamber D′ proper is formed between the bottom wall of the chamber D^3 and the adjacent ends of the inlet ports D^7.

G represents the supply conduit connected by port A^4 to the idle end of the compressing cylinder and port A^5 and conduit E connect this end of the compressing cylinder to the port D^9 leading to chamber D′. Outlet chamber D^2 is connected by port D^{10} to discharge conduit F.

The outlet ports D^6 are controlled by a sliding grid iron discharge valve H located within the outlet or receiver chamber D^2 and held in place by the strip like back bearing or guide member I which engages the narrow guide ledge H^5, centrally disposed on the back of the valve H. The guide I is supported by the cover J for the opening in the outer wall of the chamber D^2 through which the valve H may be removed and inserted and the seat for the valve may be machined.

To operate the valve H the latter has secured to it at its ends cylinders H′ and H^2. As shown, these cylinders are connected together by a rod like member H^3 received in a channel H^7 formed in the guide rib H^5. The cylinder H′ receives the trunk piston K removably secured to the head D by a piston body portion K′ which projects horizontally through one edge wall of the chamber D′, as shown in Fig. 2. A channel K^2, having an axial portion leading to the inner end of the piston K′, is connected through the pipe L with the interior of the compressing cylinder proper (see Figs. 1 and 2). This pipe serves in a well known manner to admit pressure from the compressing cylinder to the space in chamber H′ to cause the valve H to move to the right and open the outlet ports D^6 when the pressure in the compressing cylinder has risen to a predetermined value relative to the pressure in the receiver chamber D^2. The cylinder H^2 receives the end of the hollow piston like extension O′ carried by the valve closing rod O. The cylinder H^2 has axially disposed in it a piston like extension H^6 which is rigidly or integrally connected to the cylinder and fits in the hollow piston extension O′. The piston O′ is reciprocated in the direction of its length by the stem or body portion O which passes through the stuffing box N in the edge wall of the chamber D^2 and is connected at its outer end, in the form shown, to the cam lever F (see Fig. 3), which is oscillated back and forth to move the piston O′ in a known manner by means of a reciprocating cam R carried by a cam rod S which may be connected to a moving part of an engine to move in fixed relation to the movement of the piston of the engine as is usual in engines of this character.

The stuffing box N, in the form shown, is provided with an extension N^2 forming a stop or abutment against which the enlargement of the piston O′ engages to check the outward movement of the piston and the valve H. The stuffing box N also comprises a chamber N^3 into which lubricating material is supplied through the supply pipe Z. A channel O^2 formed in the stem O and piston O′ serves to convey lubricating material from chamber N^3 to the chamber in the piston O′ in which the piston projection H^6 works. This lubricates the surfaces of contact of the stem H^6 and piston O′ and also tends to equalize the fluid pressure acting on the end of the stem H^6. Ordinarily, the pressure in the chamber N^3 and against the end of the stem H^6 is approximately that of the atmosphere. Beyond the chamber N^3 the stuffing box is provided with a chamber N^4 receiving any suitable packing which is retained in place under pressure by the axially movable gland N^5. As shown in Fig. 5, the gland N^5 is a split washer and comprises an inner portion entering the end of the chamber N^4 and an outer portion threaded to receive the nut N^6 which has right and left hand threads engaging the gland and wall of chamber N^4, and is rotated to adjust the gland N^5 and thereby the pressure on the packing material. The nut N^6 is rotated by the spindle N^7 provided with the worm N^8 engaging gear teeth formed on the periphery of the nut N^6.

The operation of the delivery valve will be readily apparent to those skilled in the art. The reciprocating movements of the cam rod S and the consequent reciprocating movements of the stem O, are such as to carry the piston O′ to the extreme inner limit of its movement at the instant the compressing piston reaches the end of its

stroke toward the cylinder head D and to permit the piston O to be at the outer limit during the period in which the delivery valve should open. Fig. 2 shows the parts in the condition occupied by them during the range of movement of the compressing piston in which the delivery valve opens. Ports H^4 are formed in the wall of the cylinder H^2 which are uncovered in this condition of the apparatus, thus placing the interior of the cylinder H^2 in communication with the outlet or receiver chamber D^2. In consequence, the receiver pressure acts on the inner end wall of the cylinder H^2, to hold the valve closed, over the area equal to the cross sectional area of the chamber in the cylinder H^2 less the cross sectional area of the stem H^6. The end of the stem H^6 is subjected to a pressure which is approximately that of the atmosphere. The chamber in the cylinder H′ being in communication with the compressing cylinder, the valve H is urged toward the open position by the pressure in cylinder H′ with a force which varies with the pressure in the compressing cylinder. Until the pressure in the compressing cylinder approaches an equality to the pressure in the receiving chamber D^2, the valve is also frictionally held against movement because of the excess of pressure on its outlet side over the pressure on its inlet side. As the pressure in the compressing cylinder approaches an equality with the receiver pressure, the frictional opposition to the movement of the cylinder rapidly decreases, and the parts are so proportioned that when the pressure in the compressing cylinder reaches an equality with the pressure in the receiver, the pressure in the cylinder H′ will exceed the sum of the pressures acting against the end wall of the cylinder H^2 and the end of the stem H^6 by an amount sufficient to insure a rapid opening of the valve. After an initial movement of the valve in the opening direction something less than the full amount, the ports H^2 are closed by the ends of the piston extension O′ and the further movement of the valve is opposed and cushioned by the fluid trapped in the cylinder H^2. In consequence, the momentum of the valve is arrested without subjecting the parts to undue jar. As the stroke of the compressing piston is completed, the compressing fluid is forced through the ports D^6 and as the compressing piston nears the head D the piston O′ is moved inward to force the valve back to the closed position, the movement of the various parts being timed so that the valve reaches its closed position at the instant at which the compressing stroke is completed. With this arrangement, it will be seen that any leakage from the cylinders H′ and H^2 does not escape into the open atmosphere but into the receiver chamber D^2. This is a matter of great importance in obtaining high economy when operating with high pressures and of course is of peculiar importance where the fluid compressed is a substance like ammonia, any escape of which is a source of great annoyance if not actual physical danger to the attendants. On account of the high pressure, as well as the nature of the fluid compressed, when that fluid is ammonia or like obnoxious gas, the stuffing box for the stem O must be such as to insure a minimum of leakage along the stem. This means putting the packing in the stuffing box under a pressure which creates resistance to the movement of the stem O which is substantial in all cases and because of difficulty in obtaining a proper adjustment of the stuffing box parts is apt to vary greatly from time to time. With the arrangement disclosed the variable frictional resistance to the movement of the rod O does not affect the operation of the delivery valve, since the fluid pressure valve opening mechanism is in nowise affected by the resistance to the movement of the stem while the latter is directly and positively moved by the driving engine.

The inlet valve T controlling the ports D^7 is a sliding gridiron valve arranged as is usual on the inlet side of the ports D^7. To facilitate the formation of the seat of the valve T the latter is formed with a segment shaped boss D^{11} which extends from the inner end of the end member D proper into the compressing cylinder. In consequence, the bottom of the groove for valve seat D^{12}, and the grooves D^{13} at the sides of the seat receiving flanges T′ of the valve T may be readily machined in an ordinary planing machine. This of course would not be the case if the valve seat D^{12} did not lie above the surface D^{14} of the end head D abutting against the end of the compressing cylinder. The inlet valve T is opened and closed at fixed points in the strokes of the compressing piston by the valve stem T^3 which passes through the stuffing box N. The latter may be similar in all respects, except for the provision of the part N^2, to the stuffing box N. The outer end of the stem T is secured to a cam lever P′ oscillated by a cam R′ carried by a cam rod S′. The parts P′, R′ and S′ may be identical in construction with the parts P, R and S, and may be secured by a bracket Q′ like the bracket Q in which the lever P is journaled.

As it is necessary from a practical standpoint to locate the delivery valve H at the outlet ends of the ports D^6, and as it is desirable to avoid unnecessary clearance, the boss D^{11} is segmental, as shown, so that the inner ends of the ports D^6 are substantially flush with the end of the compression cylin-

der and the compressing piston C is provided with a segmental extension C^2 which occupies the space below the boss D^{11} when the piston is at the end of the compressing stroke.

While in accordance with the provisions of the statutes I have herein described and illustrated the best form of the invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention, and that certain features of the invention may be advantageously employed in some circumstances without a corresponding use of other features, and I do not wish the claims hereinafter made to be limited to the particular form of the apparatus disclosed more than is made necessary by the state of the art.

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

1. In a compressor having a compressing chamber and a receiver chamber and delivery ports connecting them, the combination of a sliding valve controlling said ports, means for opening said valve comprising a piston and cylinder located within the receiver and secured, the one to the valve, and the other to the engine wall, and a conduit connecting the interior of the cylinder to the interior of the compressor cylinder, and separate means for closing said valve comprising an operating member extending through the wall of the receiving chamber and adapted to engage the valve and close it when moved in one direction without opening the valve when moved in the opposite direction.

2. In a compressor having a compressing cylinder, a receiver chamber, ports connecting said chamber, and a compressing piston working in said cylinder, the combination with a sliding valve controlling said ports, of means for opening said valve, and separate means for closing the valve comprising a rod projecting through the wall of the receiving chamber, connections for reciprocating said rod in fixed time relation to the movements of the compressing piston, and a dash pot connection within the receiving chamber between said rod and said valve adapted to cushion the opening movement of the valve.

3. In a compressor having a compressing cylinder, a receiver chamber, ports connecting said chamber, and a compressing piston working in said cylinder, the combination with a sliding valve controlling said ports, of means for opening said valve comprising a piston and cylinder located within the receiver and secured one to the valve and the other to the engine wall, and a conduit connecting the interior of the cylinder to the interior of the compressor chamber, and separate means for closing the valve comprising a rod projecting through the wall of the receiving chamber, connections for reciprocating said rod in fixed time relation to the movements of the compressing piston, and a dash pot connection within the receiving chamber between said rod and said valve adapted to cushion the opening movement of the valve.

4. In a compressor having a compressing cylinder, a receiver chamber, ports connecting said chamber, and a compressing piston working in said cylinder, the combination with a sliding valve controlling said ports, of means for closing the valve comprising a rod projecting through the wall of the receiving chamber and extending parallel to the direction of movement of the valve, means for moving said rod back and forth in the direction of its length in definite relation to the movements of the compressing piston, and a piston and cylinder connection between said rod and valve located within the receiver chamber at one end of the valve and adapted to form a dash pot cushioning the opening movement of the valve, and means for opening the valve comprising a piston and cylinder connection between the valve and the wall of the receiving chamber located within the receiver chamber at the opposite end of the valve and a conduit connecting the interior of the last mentioned cylinder with the interior of the compressing cylinder.

5. In a compressor having a compressing cylinder, a receiver chamber, ports connecting said cylinder and chamber, and a compressing piston working in said cylinder, the combination with a gridiron valve controlling said ports and formed with a central elongated and longitudinally grooved back bearing surface, a pair of cylinders at the opposite ends of the valve, a rod connecting the pair of cylinders to each other and to the valves received in the grooves in the bearing surface of the valve, a second rod projecting through one wall of the receiver and provided with a piston entering one of said pair of cylinders, means for reciprocating said second rod in the direction of its length in definite time relation to the movements of the compressing piston, a piston entering the other of said pair of cylinders and secured to the wall of the receiver chamber, and a conduit connecting the interior of the last mentioned cylinder to the interior of the compressing cylinder.

6. In a compressing engine, the combination with the compressing cylinder of an end head therefor formed with a body portion abutting against the end of the cylinder, and a boss extending into the cylinder

and having an undercut seat formed in it for a sliding valve movable transversely of the cylinder.

7. In a compressor, the combination with the cylinder, of a chambered head therefor, formed with an inlet chamber and a set of inlet ports connecting said chamber and the compressing cylinder, a receiver chamber and a set of delivery ports at the side of said inlet ports connecting the receiver chamber to the compressing cylinder, a snifting port at the other side of said inlet ports, and a channel connecting the snifting port to the receiver chamber.

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Witnesses:
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