No. 643,918. Patented Feb. 20, 1900.

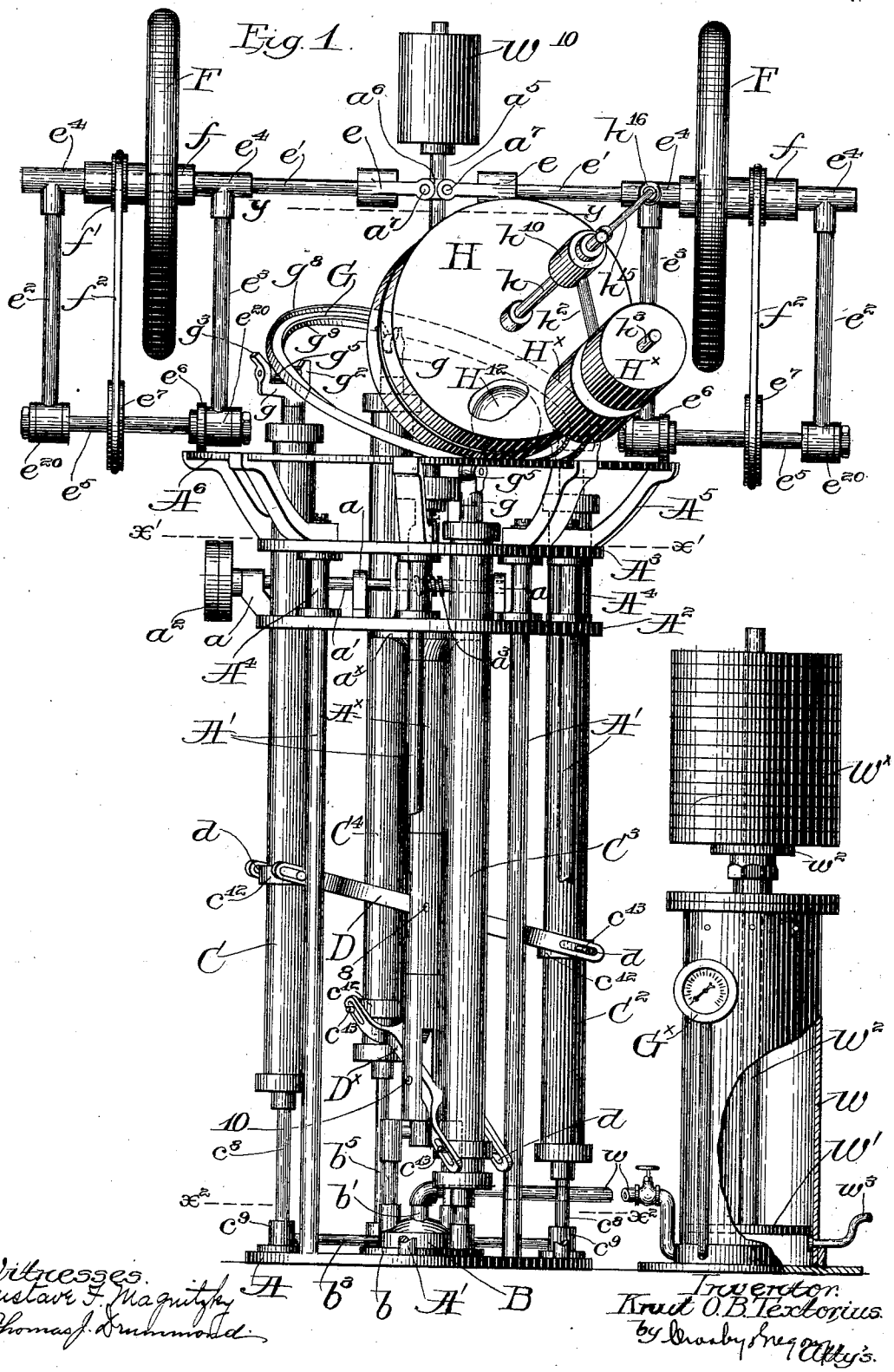
K. O. B. TEXTORIUS.

AIR COMPRESSOR.

(Application filed Apr. 26, 1899.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



Witnesses.
Gustave F. Magnitzky
Thomas J. Drummond.

Inventor.
Knud O. B. Textorius.
by Crosby Gregory & Alby's.

THE NORRIS PETERS CO., PHOTO-LITHO. WASHINGTON, D. C.

No. 643,918. Patented Feb. 20, 1900.

K. O. B. TEXTORIUS.

AIR COMPRESSOR.

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(No Model.) 5 Sheets—Sheet 2.

Fig. 2.

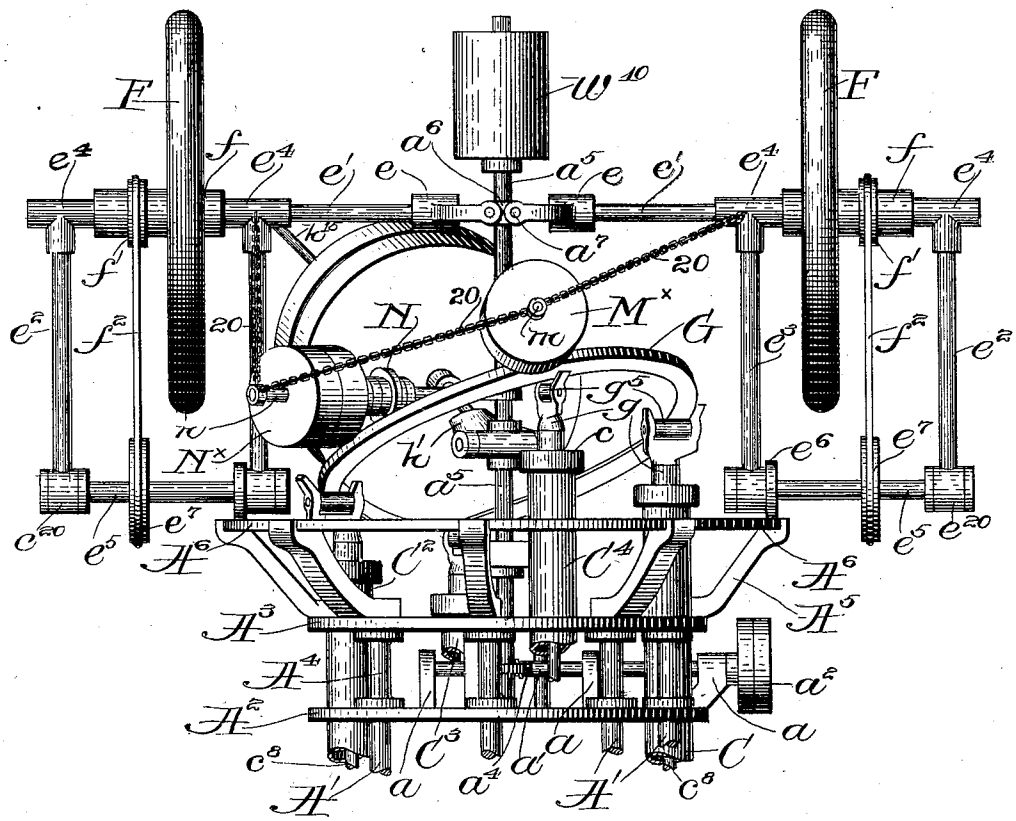
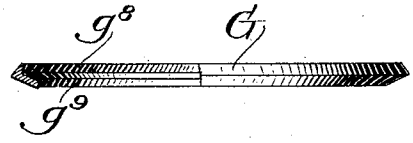


Fig. 2a.



Witnesses.
Gustave F. Magnitzky.
Charles F. Logan.

Inventor.
Kraut O. B. Textorius
by Munday, Evarts & Adcock.
Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 643,918. Patented Feb. 20, 1900.

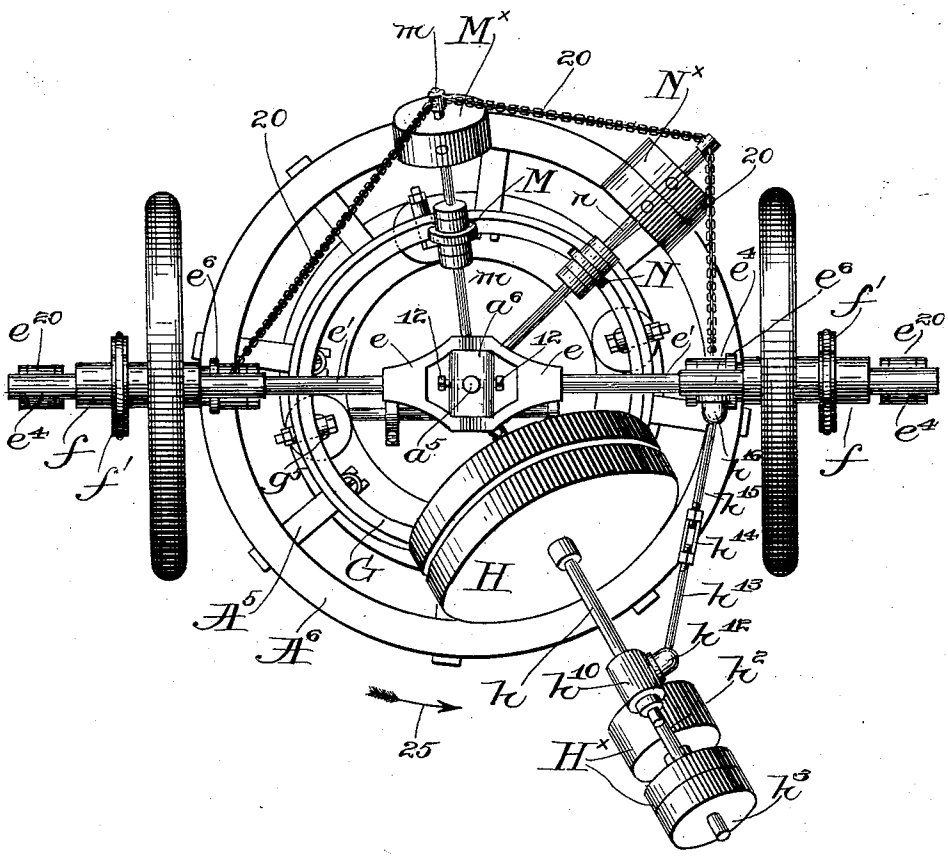
K. O. B. TEXTORIUS.

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(Application filed Apr. 26, 1899.)

(No Model.) 5 Sheets—Sheet 3.

Fig. 3.



Witnesses.
Gustave F. Magnitzky.
Thomas J. Drummond.

Inventor.
Kurt O. B. Textorius.
by Crosby & Gregory.
Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 643,918. Patented Feb. 20, 1900.

K. O. B. TEXTORIUS.

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(Application filed Apr. 26, 1899.)

(No Model.) 5 Sheets—Sheet 4.

Fig. 4.

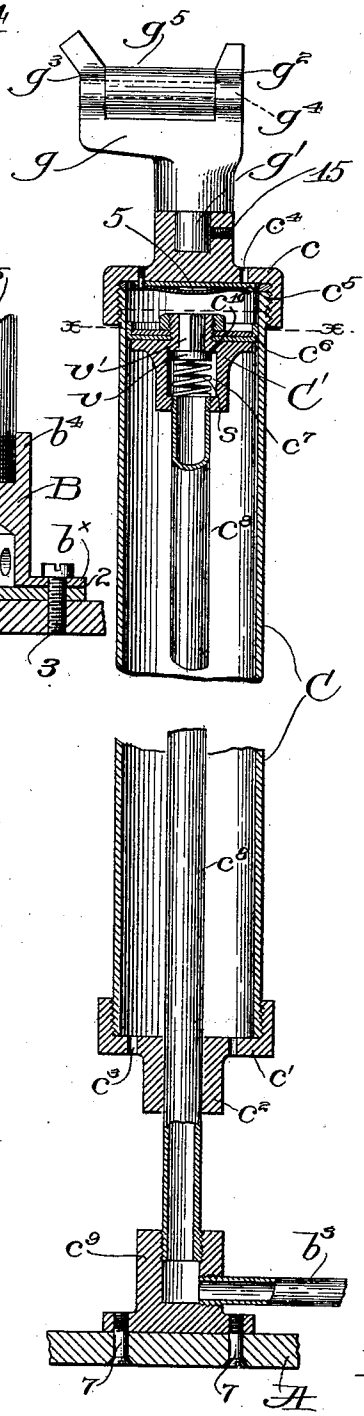


Fig. 6.

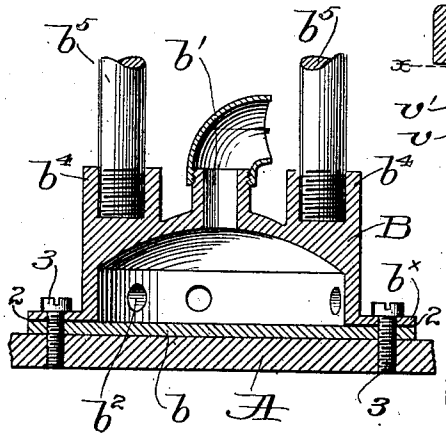
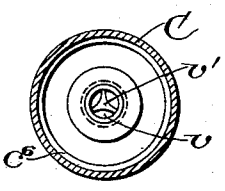


Fig. 5.



Witnesses.
Gustav H. Magnitzky.
Thomas J. Drummond.

Inventor.
Knut O. B. Textorius
by Crosby Gregory.
Attys

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AIR COMPRESSOR.

(Application filed Apr. 26, 1899.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 7.

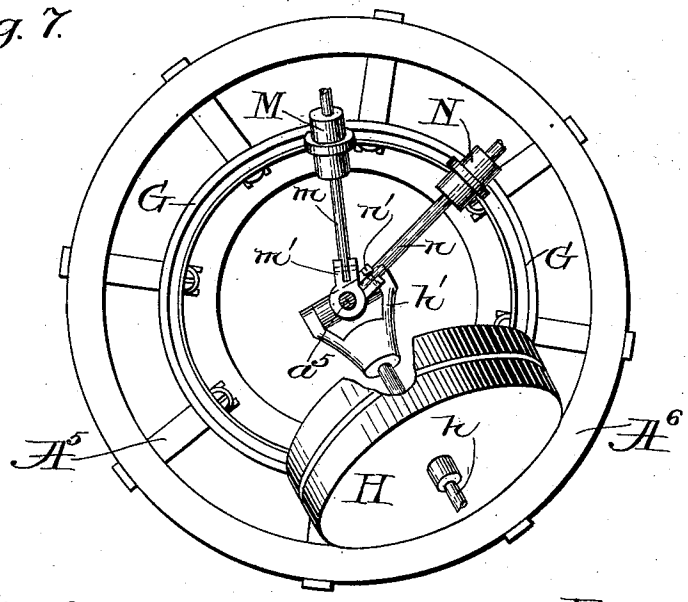


Fig. 8.

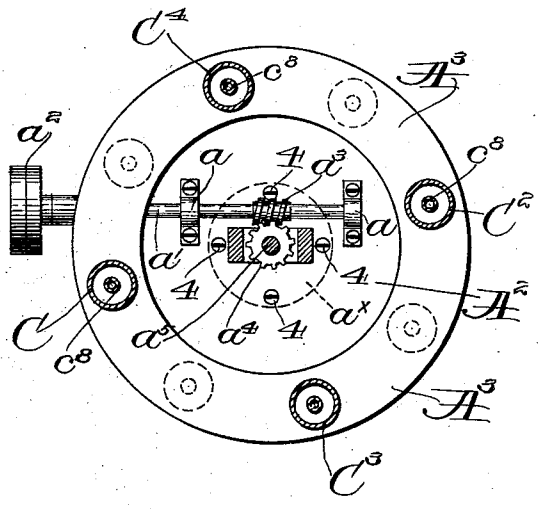
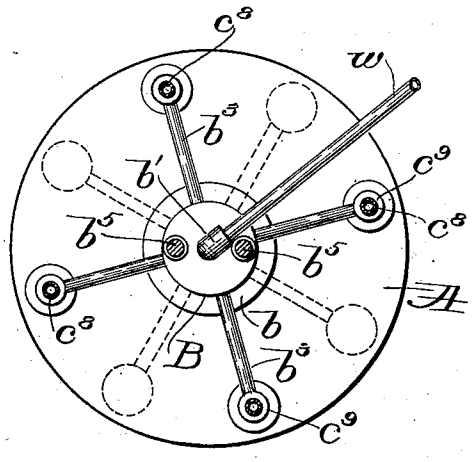


Fig. 9



Witnesses.
Gustave F. Magnitzky
Thomas f. Drummond.

Inventor.
Kraft O. B. Textorius
by Crosby, Gregory.
Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

KNUT O. B. TEXTORIUS, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF NINE-TWENTIETHS TO JOHN J. HOWARD, OF SAME PLACE.

AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 643,918, dated February 20, 1900.

Application filed April 26, 1899. Serial No. 714,571. (No model.)

To all whom it may concern:

Be it known that I, KNUT O. B. TEXTORIUS, a subject of the King of Sweden and Norway, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Air-Power Generators, of which the following description, in connection with the accompanying drawings, is a specification, like letters and numerals on the drawings representing like parts.

This invention has for its object the production of apparatus for economically and rapidly compressing air or other gas designed to be utilized as an expansible motive medium in any suitable form of engine, the apparatus being so constructed and arranged that the force of gravity is utilized in effecting the compression of the air or other gas.

Figure 1, in front elevation and partly broken out, represents a compressing apparatus embodying my invention, the storage-reservoir for the compressed air or gas being shown at the right. Fig. 2 is a rear elevation of the upper portion of the apparatus shown in Fig. 1. Fig. 2^a is a detail, partly in section and partly in edge elevation, of the gyratory track on which the secondary actuator travels. Fig. 3 is a top or plan view of the apparatus shown in Fig. 1. Fig. 4 is an enlarged vertical section, centrally broken out, of one of the compression-cylinders and coöperating parts. Fig. 5 is a transverse sectional detail on the line $x\,x$, Fig. 4, to be described. Fig. 6 is an enlarged vertical section of the common collecting-chamber with which the several compressing devices are connected. Fig. 7 is a transverse sectional detail taken on the line $y\,y$, Fig. 1, looking down, to show the parts of the apparatus hidden in Fig. 3. Fig. 8 is a transverse section taken on the line $x'\,x'$, Fig. 1, looking down; and Fig. 9 is a similar sectional view on the line $x^2\,x^2$, Fig. 1.

I have herein shown the apparatus as mounted on a bed-plate or base A, which latter is provided with a series of upright standards or columns A′, attached at their upper ends to a head comprising a circular plate A^2 and a parallel ring-plate A^3, rigidly connected and positioned by interposed short columns or struts A^4, the struts being preferably located above and practically forming continuations of the standards A′. Upturned and outwardly-extended brackets A^5, secured to the ring-plate A^3 of the head, are recessed or shouldered at their upper ends to receive a second flat ring A^6, larger in diameter than the plates A^2 A^3, as best shown in Figs. 1, 2, and 3. On the framework thus described I support a series of compressing members or pumps arranged in diametrically-opposite pairs, any suitable even number of such devices being used, and herein for the sake of clearness in the drawings I have only shown two sets or pairs, it being understood, as will hereinafter more fully appear, that the oppositely-located compressing devices are coupled or connected to operate alternately.

At or about the center of the bed-plate or base A a receiving-chamber B is mounted, said chamber, as best shown in Fig. 6, having an annular flange $b^\times$, which rests upon a supporting-plate b, any suitable packing material 2 being interposed between the flange and the supporting-plate, the chamber being rigidly attached to the base in any suitable manner, as by screws 3. This chamber has a common outlet b' and a series of inlets b^2, the latter being connected or coupled with the outlets of the several compressing devices by suitable pipes b^3, as will be described, the top of the chamber having two upturned interiorly-threaded bosses b^4, into which are threaded short posts b^5, rigidly connected at their upper ends to a compound central column $A^\times$, the enlarged head $a^\times$ thereof being secured, as by screws 4, (see Fig. 8,) to the under side of the plate A^2.

Inasmuch as the several compressing devices are alike, only one of them will be described in detail, and referring to Fig. 4 said compressing device comprises a hollow cylinder C, having tightly secured thereto upper and lower heads $c\,c'$, respectively, the latter having an elongated depending boss c^2 and provided with apertures c^3, communicating with the interior of the cylinder. The upper end or cylinder-head c is provided with an inlet c^4, closed by any suitable valve c^5, as herein shown, normally held in operative position by a spring 5 to close the inlet c^4. A piston C′, provided with suitable packing c^6, fits tightly within the cylinder, said piston hav-

ing a hollow chamber c^7 secured to or formed on its under side, into the lower end of which chamber is secured a tubular piston-rod c^8, the latter at its lower end being fitted into a hollow coupling block or union c^9, rigidly secured, as by screws 7, to the base-plate A and receiving the outer end of the pipe b^3, communicating with the receiving-chamber B. The tubular valve-seat c^{10} is formed on the upper portion of the piston C', communicating with the chamber c^7 and being entered by the triangular stem v' of a valve v, normally held seated by a spring s.

In the present instance of my invention the pump-cylinder is reciprocated relatively to its piston, the latter being rigidly held in position, as described.

Referring to Fig. 4, it will be manifest that when the cylinder is raised the partial vacuum created above the piston will permit the external pressure of the air acting through the inlet c^4 to open the valve c^5, so that the air can rush into the cylinder, and when the cylinder begins its downward stroke the air thus imprisoned will be compressed and will force the valve c^5 firmly against and to close the inlet-opening. At the same time the pressure of the increasingly-compressed air in the cylinder will unseat the valve v, so that the air will pass into the chamber c^7 and thence through the hollow piston-rod and coupling c^9 into the common receiving-chamber B.

For convenience of description the four compressing devices shown will be designated by the reference-letters C C^2 C^3 C^4.

The several cylinders pass easily through holes in the plates A^2 A^3 and are guided thereby at their upper ends during their reciprocation, the cylinders C C^2 being connected or coupled together, as are the cylinders C^3 C^4. Each cylinder is provided with an external ring c^{12}, having oppositely and laterally extended lugs or pins c^{13}, extended into the slots d in the yoke-like or bifurcated ends of like rocker-arms D $D^\times$, extended through vertical slots in the sectional column $A^\times$ and fulcrumed to said column at 8 and 10, Fig. 1. The rocker-arm D connects the cylinders C C^2 and the rocker-arm $D^\times$ the other pair, and it will be obvious that when one cylinder of a connected pair is raised its fellow will be lowered, and vice versa, it being clear from an inspection of Figs. 1 and 9 that the couplings c^9, and hence the several compressing devices, are arranged symmetrically about the central column $A^\times$ and equidistant therefrom.

A reservoir W, Fig. 1, is connected by a suitable pipe w with the outlet b' of the receiving-chamber B, said reservoir having a tightly-fitting piston W', its piston-rod W^2 extending upward through a suitable stuffing-box in the top of the reservoir and having fast upon it a collar or annular flange w^2, upon which may be piled weights $W^\times$ to obtain the desired degree of compression, the pressure within the reservoir being indicated by a suitable gage $G^\times$, connected with the lower part of the reservoir.

As the several compressing devices operate they serve to force compressed air into the receiving-chamber B, and when the pressure in said chamber is sufficient to overcome the pressure of the weighted piston W' in the reservoir the latter will be raised sufficiently to admit an additional supply of air thereto, the reservoir-inlet being provided with a check-valve, as usual. The compressed air from the reservoir is conveyed, by means of a delivery-pipe w^3, Fig. 1, to the engine, which is to be driven by the expansive power of the compressed air or gas.

Brackets a on the plate A^2 provide bearings for a horizontal shaft a', which is rotated in any suitable manner—as, for instance, by belting from a suitable source of power (not shown) passed around a pulley a^2 on the shaft, the latter having fast upon it a worm a^3, (best shown in Fig. 8,) in mesh with a worm-gear a^4, fast on a vertical shaft a^5, supported by suitable bearings (not shown) upon the framework and extended up for some distance above the head of the main frame and weighted at its upper end, as at W^{10}. A block a^6 is secured, as by set-screws 12, to the shaft near its upper end and pivotally connected at a^7, Fig. 1, with oppositely-extended yokes e, to which are secured, preferably, horizontally-extended arms e', each provided at or near its outer end with two depending hangers e^2 e^3, rigidly connected at their upper ends to the arm e' by the T-couplings e^4, tightly fitting the arm e', the lower ends of the hangers being provided with journal-boxes e^{20} for a shaft e^5, provided with a wheel e^6 to travel on the circular track A^6. Between each pair of couplings e^4 the hub f of a fly-wheel F is rotatably mounted on the arm e', the hub being provided with a sheave f', connected by a band or other suitable flexible connection f^2 with a larger sheave e^7, fast on the shaft e^5. The two fly-wheels F are diametrically opposite each other, as will be clear from an inspection of the drawings, and the rotation of the shaft a' will, through the worm and worm-gear, rotate the vertical shaft a^5 to thereby cause the arms e' and the parts carried thereby to rotate bodily around the shaft a^5 as a center. As the wheels e^6 are thus made to travel over the track A^6 they will be rotated, and the rotation of the shafts e^5 thus effected will be transmitted through the flexible connections f^2 to the fly-wheels F, so that the latter will not only rotate bodily about the vertical center of the apparatus, but they are also rotated on their own axes, the direction of axial rotation being in the direction of bodily travel of said wheels. These fly-wheels serve to equalize the motion of the apparatus and to prevent jerks in its action.

The head c of each of the compressing-cylinders is socketed to receive the shank g' of a roll-carrier g, (shown most clearly in Fig. 4,)

said carrier having upturned ears g^2 g^3 to receive between them the pivot stud or axle g^4 of an antifriction-roll g^5, the inner faces of the ears being flared at their upper ends. A gyratory annular track G rests upon and is supported by the several rolls g^5, the latter being arranged radially to the shaft a^5 and held in such position by set-screws 15, Fig. 4, I having designated the track as a "gyratory track," for the reason that it describes a gyratory movement, as will be described, the rising and falling of the several carrier-rolls g^5 corresponding to the gyrations of the track. The inner face of the track is flanged at its upper and lower edges, as at g^8 g^9, Fig. 2^a, and on such inner face of the track travels the secondary actuator H, the primary actuator of the apparatus being the motive power which operates to rotate the shaft a'. The secondary actuator is shown as a hollow drum rotatably mounted on an arm h, pivotally connected at its inner end by a yoke h' to the vertical shaft a^5, the outer end of the inclined arm h being herein shown as provided with a depending arm h^2, provided with a cross-piece h^3, on which additional weights, as H^X, may be hung, if desired, to increase the power of the secondary actuator H.

It will be manifest by reference to Fig. 3 that the gyratory track and the carrier-rolls g^5 therefor are within the fixed track A^6, so that said carrier-rolls may rise and fall and the track G gyrate without interference by the fixed track A^6, and referring to Fig. 3 it will be seen that the lateral arms e', which carry the fly-wheels F, are always a fixed angular distance from the arm h of the secondary actuator by reason of their several connections with the vertical shaft a^5.

The hollow drum H is shown for convenience as made in two halves, with their closed ends outward, and I have herein shown a heavy metal sphere H^{12}, (see full lines, Fig. 1,) preferably solid, as inclosed in the drum and free to move therein, the object of this construction being to get a heavy actuator, but to bring the main portion of the weight below the center of rotation h and as near as possible to the gyratory track G. By varying the size of the sphere H^{12} the effective weight of the actuator can be varied according to circumstances. If desired, the drum may be provided with one or more internal annular compartments, in each of which a spherical weight may be placed. The flanges g^8 and g^9 serve to prevent displacement of the actuator H, the inner face of the flange g^9 being beveled to correspond with the inclination of the periphery of the drum.

In order to prevent the weight of the actuator from tipping the track G, and thereby lifting it from off the carrier-roll farthest removed from this secondary actuator, I provide a retaining device comprising a detent-wheel M, rotatably mounted on an arm m, connected with the shaft a^5 by a coupling m', Fig. 7, the arms m and h being somewhat less than one hundred and eighty degrees apart, as herein shown, said wheel M traveling on the gyratory track and maintaining the latter seated on its carrier-rolls by virtue of the weight M^X, carried by the outwardly-extended end of the arm m. Between the secondary actuator and the track-retaining device described a second arm n is connected by a coupling n' with the vertical shaft a^5, said arm also having a wheel N to travel on the gyratory track in advance of the secondary actuator and weighted, as at N^X, Fig. 3, the two arms m and n being retained from lateral displacement by a chain or other flexible connection 20, Figs. 2 and 3, attached at its ends to the opposite couplings e^4, as herein shown, and to the arms m and n at or near their extremities, such flexible connection in no wise interfering with the vertical movement of the arms during the gyrations of the track G.

The arrow 25 in Fig. 3 indicates the direction of rotation of the shaft a^5 and the parts connected therewith—that is to say, the radial arms e', m, n, and h and the several parts carried by said arms—it being remembered that the secondary actuator H, the track-retaining wheel M, and the depressing-wheel N are all moved bodily in the same direction, while they rotate about their own axes.

The point of contact of the secondary actuator and the track G is never at any instant at the lowest point of such track, but a little behind it, so that as the secondary actuator is moved in its horizontal path by the rotation of the shaft a^5 the weight of said actuator on the track tends to give a gyratory motion to the latter, which latter motion is transmitted through the several carrier-rolls g^5 to the compression-cylinders one after another, and the compression of the air is effected in a very economical and uniform manner.

The friction between the secondary actuator and the gyratory track and between the latter and the supporting-rolls therefor is rolling friction, and therefore the power of the primary actuator required to overcome friction is reduced to a minimum, so that the power thus made effective is utilized in effecting the bodily movement of the secondary actuator and the other rotating parts of the apparatus. In other words, the constant tendency of the actuator is to find the lowest point of the track; but by means of the gyratory movement of the track this lowest point is always maintained in advance of the point of contact of the secondary actuator.

The depressor N operates to assist the secondary actuator or increase its effectiveness, it being of course manifest that the action of gravity through the actuator serves to depress one compression-cylinder after another as the actuator H is moved through its horizontal path of travel.

My invention is not restricted to the particular number of compressing devices herein shown; but it is requisite that there be an even number substantially radially arranged

and coupled together in pairs, so that the compressing action of one of a pair takes place during the suction movement of its fellow.

The lower ends of the compressing-cylinders are made open or apertured, as has been described, in order to allow free ingress or egress of air to the cylinder on the lower side of the piston at each stroke.

I have not herein shown in detail any special means for making the various joints and other portions of the apparatus air-tight, as any suitable packing means may be employed.

The sleeve h^{10} on the arm h is provided with the socket member h^{12} of a ball-and-socket joint, the ball member being formed on or secured to one end of a brace-rod member h^{13}, made in two parts and connected by a turnbuckle h^{14}, the other member h^{15} of the brace-rod being connected by a ball-and-socket joint h^{16} with one of the couplings e^4 of the equalizer. By means of the turnbuckle the rod can be tightened as needed and the actuator H is maintained in proper angular relation with the equalizer.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an apparatus of the class described, compressors the movable members of which are connected in pairs to reciprocate alternately, a gyratory annular track supported by the movable members of the compressors and disposed in an inclined plane, a weighted wheel located to travel upon said gyratory track, means for supporting and operating the wheel, a second weighted wheel mounted to travel upon said track, and means whereby said second weighted wheel is held in working position to prevent the gyratory track from tilting.

2. In an apparatus of the class described, compressors the movable members of which are connected in pairs to reciprocate alternately, a vertical shaft having two oppositely-disposed arms, a shaft provided with a weighted wheel adapted to travel upon said gyratory track, two weighted wheels flexibly connected with each other and also with said last-mentioned shaft and to one of said arms.

3. In an apparatus of the class described, a main frame comprising a base-plate, upright standards, and a head carried by the latter, a receiving-chamber on the base-plate, a series of compressors radially arranged about said chamber, each compressor including a cylinder and a valved piston therein, a fixed, hollow piston-rod therefor communicating with the receiving-chamber, and a vertically-movable cylinder having an inlet-valve, a rocking arm mounted on a fixed pivot and connecting the cylinders of opposite compressors, a series of bifurcated members connected to the upper ends of the cylinders, and provided with supporting devices between the branches thereof, a gyratory, annular track adapted to rest upon said supporting devices, an actuator adapted to roll upon said track, means to move said actuator bodily in a substantially horizontal, circular path, whereby the weight of said actuator will operate to depress the cylinders one after another, and means to retain the upper portion of the track in place.

4. In an apparatus of the class described, compressors including movable members, a gyratory annular track adapted to actuate the movable members of the compressors and disposed in an inclined plane, a shaft provided with oppositely-disposed arms having equalizing-wheels, a weighted member adapted to travel upon the gyratory track and connected to one of said arms and also to said shaft, means to prevent the track from tipping, and means to cause the rotation of the equalizing-wheels during the travel of said weighted member.

5. In an apparatus of the class described, a plurality of compressors disposed in a circle, each compressor including a vertically-reciprocatory cylinder having a fixed piston, a common receiver connected with and adapted to receive compressed air from said compressors, the cylinders of opposite pairs being connected to reciprocate alternately, an inclined annular track resting upon the upper ends of said cylinders and also a flange having a beveled inner face, a vertical shaft, means to rotate said vertical shaft, a rotative actuating member connected with said shaft and having a beveled periphery adapted to roll against the beveled face of said flange, and having a preponderance of weight below its axis of rotation, an equalizing mechanism connected with said shaft including two diametrically-opposite fly-wheels, and means for rotating the fly-wheels during the travel of said rotative member.

6. In an apparatus of the class described, compressors the movable members of which are connected in pairs to reciprocate alternately, a gyratory, annular track mounted on the movable members of the compressors, and lying in an inclined plane, means to impart gyratory movement to said track, a fixed, horizontal track, and an equalizer rotatable thereupon, said equalizer including one or more fly-wheels rotatable about a horizontal axis, and means to rotate said equalizer bodily and also to rotate the fly wheel or wheels.

7. In an apparatus of the class described, a series of air-compressing devices, a receiver with which they are connected, a gyratory annular track supported by the movable members of said devices, an actuator adapted to move upon and gyrate the track, a shaft provided with oppositely-disposed arms carrying fly-wheels, a second shaft connected to the first-mentioned shaft and supporting said actuator, an adjustable connection between said second shaft and one of the arms, and means to rotate said fly-wheels during the travel of said actuator.

8. In an apparatus of the class described, a series of compressors arranged in a circle,

the movable members of said compressors being connected in pairs to reciprocate alternately, an annular, gyratory track supported by the movable members and lying in an inclined plane, a centrally-disposed, vertical shaft, an actuator connected therewith and adapted to roll on and to effect gyratory movement of the track, the lowest point in said track being always maintained in advance of the point of contact of the actuator and the track, and an auxiliary roll adapted to travel on the track and in advance of the lowest point of the latter, connections between said roll and the vertical shaft, and means to rotate the latter to thereby move the actuator and auxiliary roll in a substantially horizontal, circular path.

9. In an apparatus of the class described, a main frame having a circular, horizontal head, a fixed annular track mounted thereupon, a centrally-disposed, vertical shaft, a frame connected therewith and carrying diametrically-opposite fly-wheels mounted to rotate on horizontal axes, rolls on said frame to travel on the track, connections between said rolls and fly-wheels to rotate the latter on their axes, a plurality of compressors, each comprising a fixed and a movable member, the latter being adapted to reciprocate vertically in bearings in the head, connections between the movable members of opposite pairs of compressors, whereby they will be reciprocated alternately, a gyratory, annular track mounted on the upper ends of the movable members and the compressors, and lying in an inclined plane, and a heavy actuating-roll adapted to travel upon the gyratory track and gyrate the same, and therethrough operate the compressors one after another, a connection between said roll and the vertical shaft, whereby the roll is bodily moved in a circular, horizontal path as the shaft is rotated, and means to rotate said shaft.

10. In an apparatus of the class described, a series of air-compressing devices, a gyratory track coöperative with the air-compressing devices, a weighted actuator mounted upon said gyratory track, a shaft provided with oppositely-disposed arms carrying fly-wheels, a support for said actuator connected to said shaft and also to one of said arms, a horizontal circular track located outside of the first-mentioned track, rotative driving means adapted to travel upon and to be operated by said last-mentioned track, and connections between said rotative driving means and the fly-wheels for operating the latter.

11. In an apparatus of the class described, a series of air-compressing devices, a gyratory track coöperative with the air-compressing devices, a weighted actuator mounted upon said gyratory track, a shaft provided with oppositely-disposed arms carrying fly-wheels, a support for said actuator connected to said shaft and also to one of said arms, a horizontal circular track located outside of the first-mentioned track, rotative driving means adapted to travel upon and to be operated by said last-mentioned track, and connections between said rotative driving means and the fly-wheels for operating the latter, two weighted arms located at relatively-remote points from the weighted actuator and serving to prevent the tipping of the gyratory track, and flexible connections between said weighted arms and the first-mentioned arms.

12. In an apparatus of the class described, a series of air-compressing devices, connected in pairs to compress alternately, a common receiver connected with said devices, an axially-rotatable, drum-like actuator movable in a circular, horizontal path, a spherical weight loose in the actuator, a gyratory track interposed between the compressing devices and the actuator and on which the latter rolls, means to move said actuator bodily to thereby gyrate the track and operate the compressing devices, one or more weighted devices mounted for movement upon the track at a point or points remote from said actuator, and means whereby said weighted device or devices will be caused to move in unison with the actuator.

13. In an apparatus of the class described, a series of air-compressing devices, an annular gyratory track mounted on the upper ends of the movable members of said compressing devices, a vertical shaft extending through said track and provided above the same with oppositely-disposed arms, a second shaft connected to said first-mentioned shaft and also to one of said oppositely-disposed arms, and provided with a weighted actuator adapted to travel on said track, a second pair of shafts connected to the vertical shaft and each having a wheel adapted to roll upon the gyratory track at a point remote from said actuator, flexible connections between said pair of shafts and also between the same and said oppositely-disposed arms, governors carried at the ends of said oppositely-disposed arms, and means for operating said governors during the travel on said actuator.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

KNUT O. B. TEXTORIUS.

Witnesses:
GEO. W. GREGORY,
JOHN J. HOWARD.