No. 676,349. Patented June 11, 1901.

F. H. BIASSE.

COMBINED AIR COMPRESSOR AND EXPLOSIVE MOTOR.

(Application filed Aug. 30, 1898.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

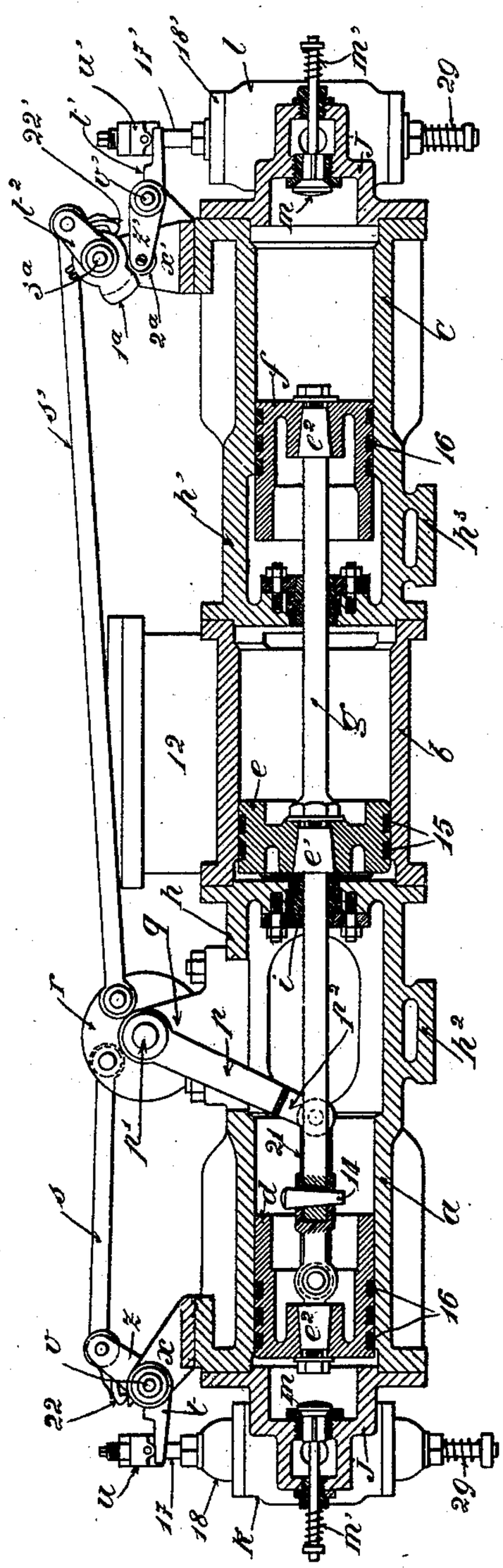


FIG. 4.

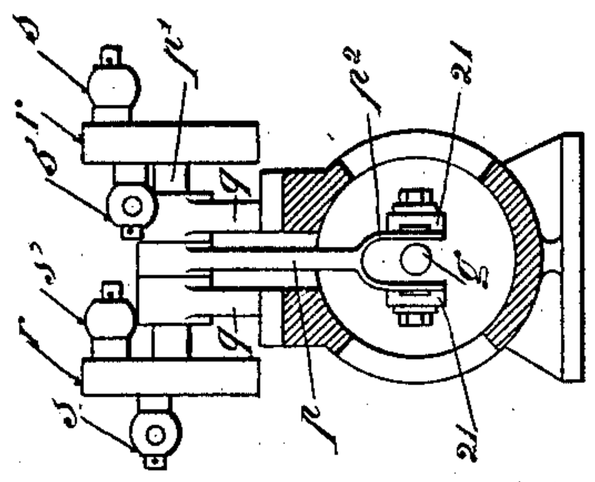
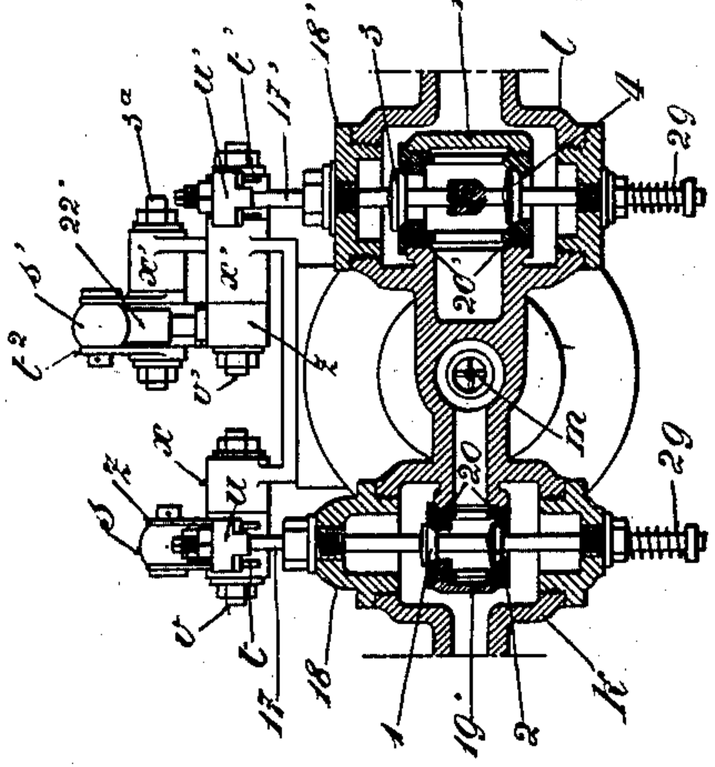


FIG. 3.



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(No Model.) 2 Sheets—Sheet 2.

FIG. 2.

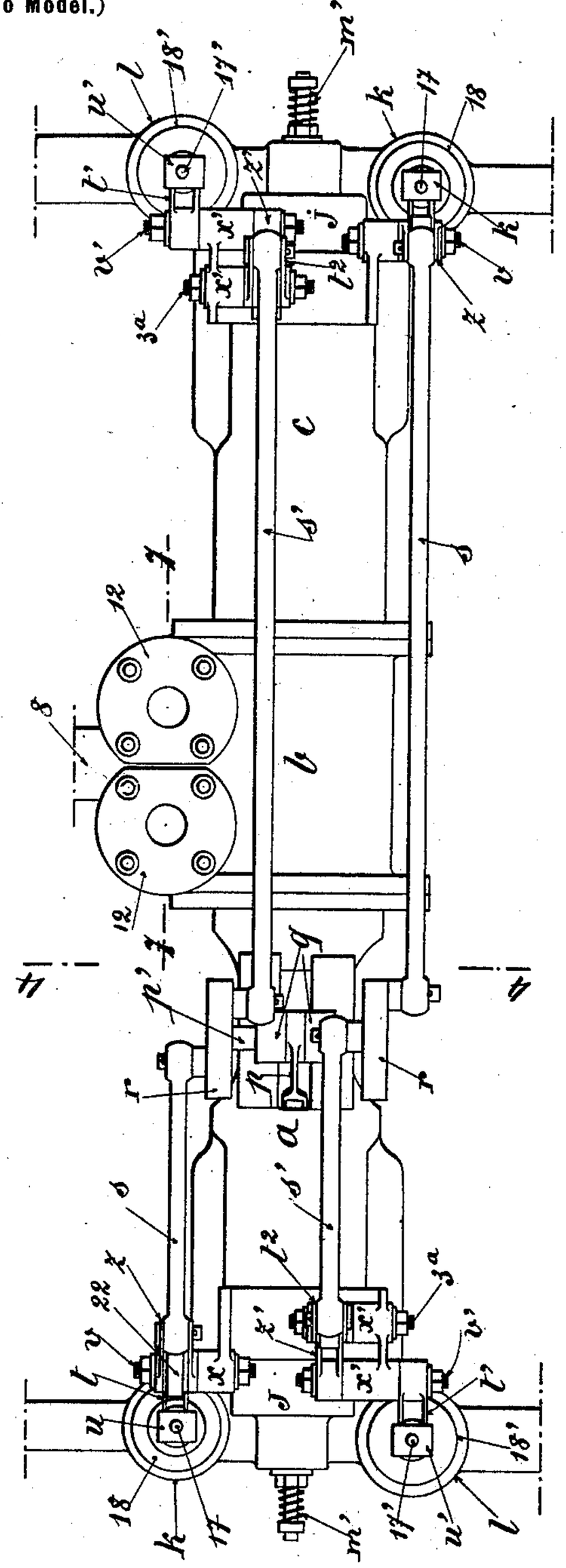


FIG. 7.

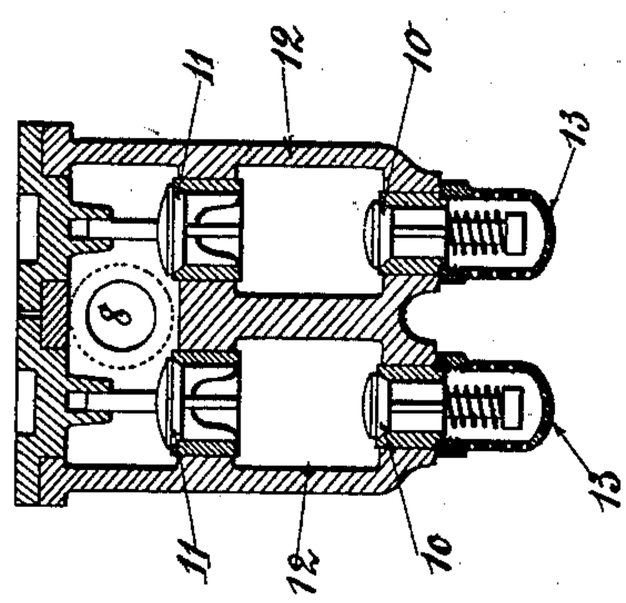


FIG. 6.

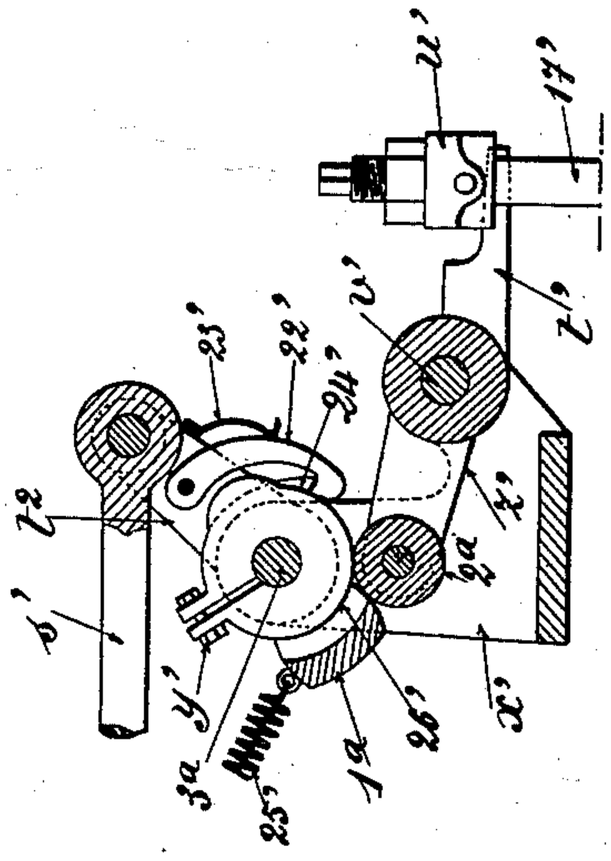
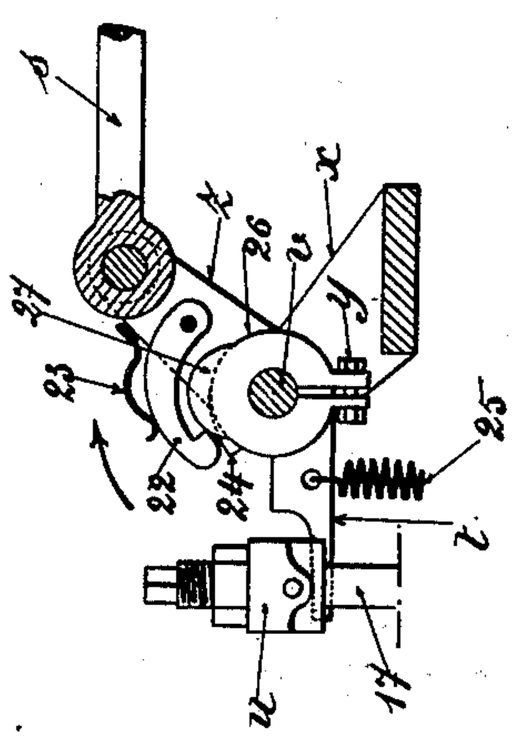


FIG. 5.



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UNITED STATES PATENT OFFICE.

FRANCIS HENRI BIASSE, OF PARIS, FRANCE.

COMBINED AIR-COMPRESSOR AND EXPLOSIVE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 676,349, dated June 11, 1901.

Application filed August 30, 1898. Serial No. 689,839. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS HENRI BIASSE, engineer, of 255 Rue St. Honoré, Paris, in the Republic of France, have invented certain new and useful Improvements in Air-Compressors and Explosive-Motors for the Propulsion of Motor-Cars, Ships, and the Like, of which the following is a specification.

The invention relates to air-compressors and explosive-motors combined, by which can be used in the place of steam as a source of energy and for all manufacturing purposes either gas, mineral oil, or hydrocarbons.

I employ the "gas" or "mineral" motor, properly so called, to generate compressed air, and I then use this compressed air as the motive fluid in an ordinary receiving-motor. This system of generating motive power offers the very great advantage of not requiring any furnace and only a very small space for storing considerable energy. The same operative parts as those used in steam-engines for changing speed and reversing the engine may be applied to it, so that it can be used for motor-cars, street-cars, for the propulsion of ships, for operating elevating and shipping apparatus in ports and elsewhere, and in general in all places where a powerful and compact generator is required.

In the accompanying drawings, Figures 1, 2, 3, and 4 are respectively a sectional elevation, a plan view, and two transverse sectional views of a double-cylinder mineral-oil motor with its single-cylinder air-compressor. Fig. 5 is a view, on a larger scale, partly in section and partly in elevation, of the mechanism which controls the admission. Fig. 6 is a similar view concerning the exhaust. Fig. 7 is a vertical sectional view through the valve-boxes on the line 7 7 of Fig. 2.

The motor comprises three cylinders *a b c*, placed end to end, and in which move three pistons *d e f*, mounted on a common piston-rod *g*. The piston-rod *g* is formed in two pieces keyed together at 14, so as to allow of easily mounting the several parts of the mechanism. The middle cylinder *b* is the compressing-cylinder. It is double-acting—that is to say, during each stroke of the piston it draws in atmospheric air behind the piston and at the same time drives forward the air drawn in during the previous stroke. The valve-boxes 12 are cast with the cylinder *b*. Each incloses at its lower part a suction-valve 10, and at its upper part a force-valve 11. The former draws in atmospheric air through a hood made of wire-gauze 13 in order to exclude dust or other foreign matter from the apparatus. Piston *e* of cylinder *b* has two packing rings or segments 15 15, cast in hard metal. It is mounted on a milled or roughened conical shoulder *e'* of the piston-rod *g*. The two hydrocarbon motive cylinders *a* and *c*, placed at the ends of the compressing-cylinder *b*, are of the same diameter and single-acting. They use the energy produced by the ignition of the explosive mixture for actuating the compressor. While the motive gases are expanding and operating in one of said cylinders *a* or *c* the burned gases of the other cylinder are being expelled. Therefore the operation of the two cylinders *a* and *c* is the same as that of a double-acting single cylinder; but the advantage obtained is in the abolition of the resistance and other objections due to the use of stuffing with the piston-rods where a single cylinder is operated.

The two motive cylinders *a* and *c* are each cast in one piece with a cylinder head or cover *h* or *h'*, forming the covers of the compressing-cylinder *b*. These covers fit with precision in the body of the latter cylinder, whereby the concentricity of all three of these cylinders is secured without difficulty. Each of the covers *h* and *h'* carries a transversely-disposed flat part h^2 or h^3 for supporting the whole on a suitable base-plate. The cover of the cylinder *a* is longer than the cover of cylinder *c*, because it must leave clearance for the hereinafter-described devices which control the distribution.

The pistons *d* and *f* of the motive cylinders have each three packing rings or segments 16. The lengths of these pistons *d* and *f* are greater than their diameters in order that they may be well guided and fit air-tight in their cylinders. They are mounted on the piston-rod *g* in the same manner as the compressing-piston *e* by being fixed on a milled or roughened conical part e^2 of the piston-rod *g*. One of the pistons *d* or *f* is constantly moved by the expansion of the gases, while the other piston *d* or *f* repels the spent gases of its cylinder toward the escape into the

air. The piston-rod *g* is rendered air-tight at the orifices of the compressing-cylinder *b* by means of a metal stuffing formed by a slit ring having a double tapering surface *i*, preferably of regulus, melting at 400° centigrade only.

Each of the motive cylinders *a* and *c* terminates at its outer end in a breech *j*, the capacity of which corresponds, or nearly so, to the volume of explosive mixture introduced. The ignition of the explosive mixture takes place soon after the beginning of the stroke of the piston. The proportion between the capacity of the breech and the capacity of the whole cylinder constitutes the rate of expansion.

Each breech is cast in one piece, with two valve-boxes *k* and *l* placed at the back, the box *k* being for the admission and the box *l* for the escape of the gases. The said boxes *k* and *l* are closed by screw-threaded covers 18 18′, having bronze stuffing for the passage of the valve-rods 17 17′. (See Fig. 3.) The said valves are balanced and held to their seats by weak springs 29 and are each composed of two tapering valve parts in cast-steel 1 2 and 3 4, mounted at a fixed distance on the same spindle 17 17′ and resting on a double seat 20 20′, also of steel, and screwed in the inner casing 19 19′ of the valve-boxes *k* and *l*. The two tapering valve parts 1 2 or 3 4 are of diameters somewhat different, the result being that the effort to be exercised to bring about the opening of the valves is only equal to the pressure which is exercised on a surface equal to the difference of the sections of the valve parts, whereby the strain on the parts operating the valves is reduced to a minimum.

The bottom of the breech *j*, communicating with the admission-box *k*, is closed by a stop-valve *m*, opening inwardly and kept in its seat by a weak spring *m*′. During the admission the stop-valve *m* opens under the pressure of the explosive mixture and then closes of itself under the pressure of the explosion. The object of the stop-valve *m* is to prevent excessive heating of the admission-valves, and especially to prevent the propagation of the ignition into the box *k* and into the ducts leading from the explosive mixture into the motive cylinder.

The upward movement of the distributing-valves is obtained in the following manner: Two pitmen 21 21, Figs. 1 and 4, attached at a point to the piston-rod *g* toward the outer cylinder *a*, are pivoted to the end of the rod *p*, fixedly attached to a rocking spindle *p*′, which is guided in the brackets *q q* on the forward cylinder-cover. Fig. 4 shows that the rod *p* at its lower part embraces the piston-rod *g* by means of a fork or bifurcation p^2, which carries the joints or pivots of the pitmen 21. A recess above the cover of said forward cylinder *a* and between the two brackets *q q* gives clearance to the rod *p* and leaves the same free to move. Two crank-disks *r r* are fixedly and symmetrically attached to the rocking spindle *p*′, and two pairs of pitmen *s s*′, pivoted at one end to each of the plates *r*, operate at their other end valve-controlling mechanism, the pitmen *s* operating the distributing-valves *k* of the cylinders and the pitmen *s*′ the escape-valves *l*, Figs. 1, 2, 5, and 6.

The controlling mechanism of the distribution is best shown in detail in Fig. 5. The pitman *s* is pivoted to one end of a lever *z*, (see also Fig. 1,) the other end of which is pivoted to a fixed spindle *v* in bearings *x x*, fixed by bolts to the end of each driving-cylinder. The said lever *z* carries a pawl 22, kept back toward the center of oscillation by a flat spring 23. During the rocking motion of the pitman *s* and the lever *z* the said pawl or catch 22 comes and catches behind a nose or lip 24 of a lever *t*, pivoted also to the spindle *v* and drawn downward by the action of a spring 25 on the main frame. The said lever *t* bears under the plate *u*, formed at the top of the valve-rod 17. When the lever *z* is drawn by the pitman *s* in the direction of the arrow, the catch 22 causes the lever *t* to turn, whereby the distributing-valve is raised. Furthermore, on the fixed spindle *v* is also fixedly mounted a cam 26, the projection 27 of which can be previously set in the desired direction and then fixed in position by means of nuts *y*. The said projection 27 of the cam 26 comes and disengages the catch 22 at the proper time and without any jarring or shock, so that the lever *t* is returned to its primary position by the spring 25, the valve *k* closing of itself under the influence of the pressure of the gases and the action of its contracting-spring 29.

The distributing-valve must be open during a very small portion only of the stroke; but it is not the same in that which concerns the escape-valve, which must remain open during almost the whole of the stroke. For that purpose the plate *u*′ of the valve-rod 17′, Fig. 6, can be raised by arm *t*′ of the bell-crank lever *z*′ *t*′ rocking on a pivot *v*′ in a bearing *x*′. The other arm *z*′ carries a roller 2^a, operated by the movable cam 1^a, loosely mounted on the spindle 3^a and provided with a lip 24′. The said lip 24′ is subjected, as hereinbefore described, to the direct action of the catch 22′, having a spring 23′, and which is carried by the lever t^2 of the pitman *s*′. The form of the cam 1^a is so predetermined as to move the part quickly up to an extent corresponding to the full opening of the valve, which must be maintained during the whole of the escape. When the disengagement takes place through the action of the fixed cam 26′, set and fixed in position by the clamping-nuts *y*′, the movable cam 1^a is returned to its primary position by its contracting-spring 25′, the valve *l* then being left to close of itself.

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

A combined air-compressor and explosive-motor comprising two single-acting explosive-cylinders *a* and *c* having inlet and exhaust ports with valves controlling the same; a double-acting compressor-cylinder *b*, placed between the said motive cylinders; one and the same piston-rod *g* on which the pistons *d* and *f* of the motive cylinders and the piston *e* of the compressor-cylinder are mounted; the rod *p* connected to the said piston-rod; the rock-shaft *p'* actuated by the rod *p*; the crank-disks *r* mounted on the said shaft; two pairs of pitmen *s*, *s'*, pivoted each to one of the said disks, and mechanism actuated by the pitmen for controlling the operation of the valves, substantially as set forth.

Signed at Paris, in the Republic of France, this 28th day of July, 1898.

FRANCIS HENRI BIASSE.

Witnesses:

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EUGÉNE WATTIER.