No. 689,272.

Patented Dec. 17, 1901.

A. BAILLY.

BLOWING ENGINE.

(Application filed June 29, 1899.)

(No Model.)

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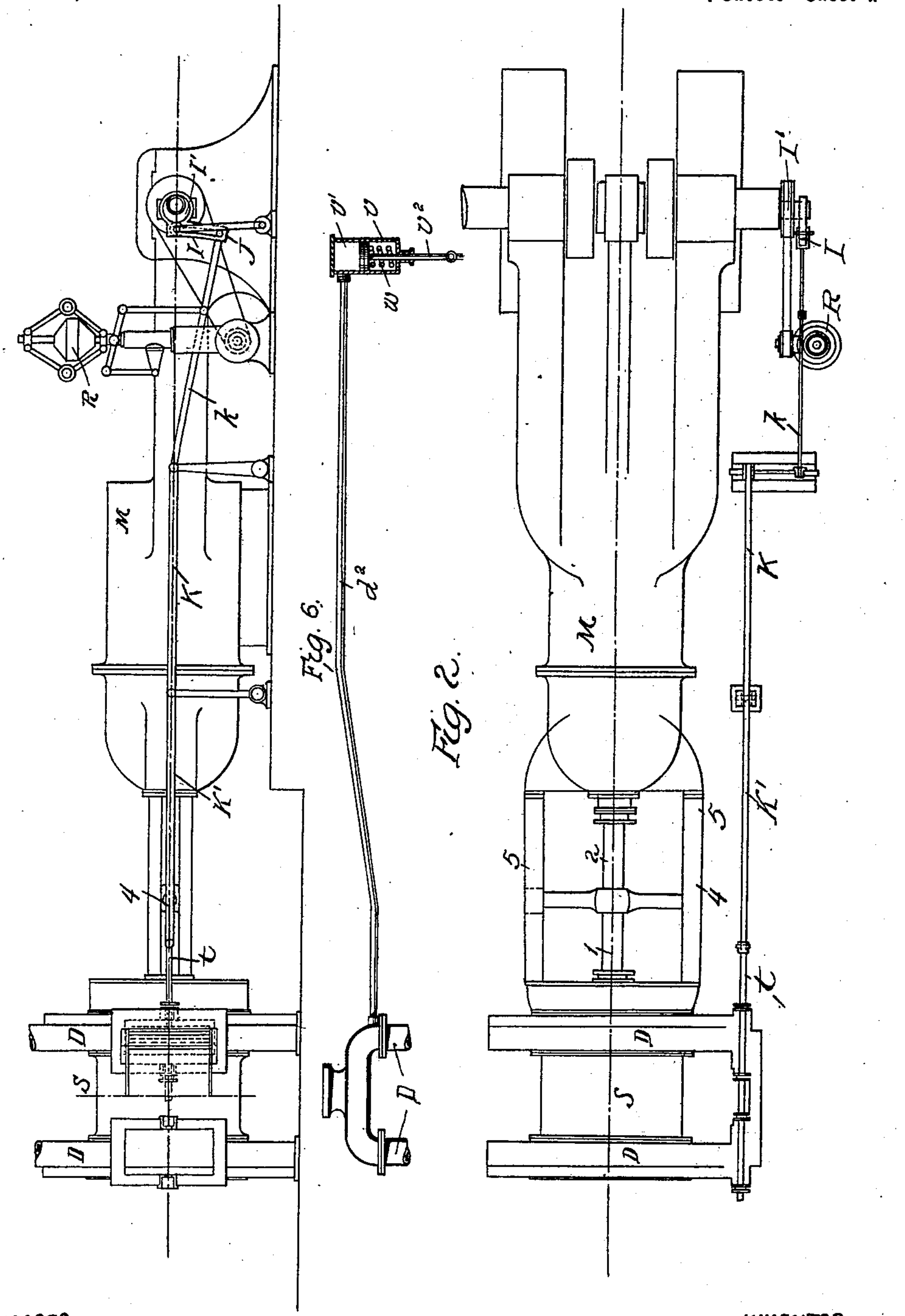

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(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

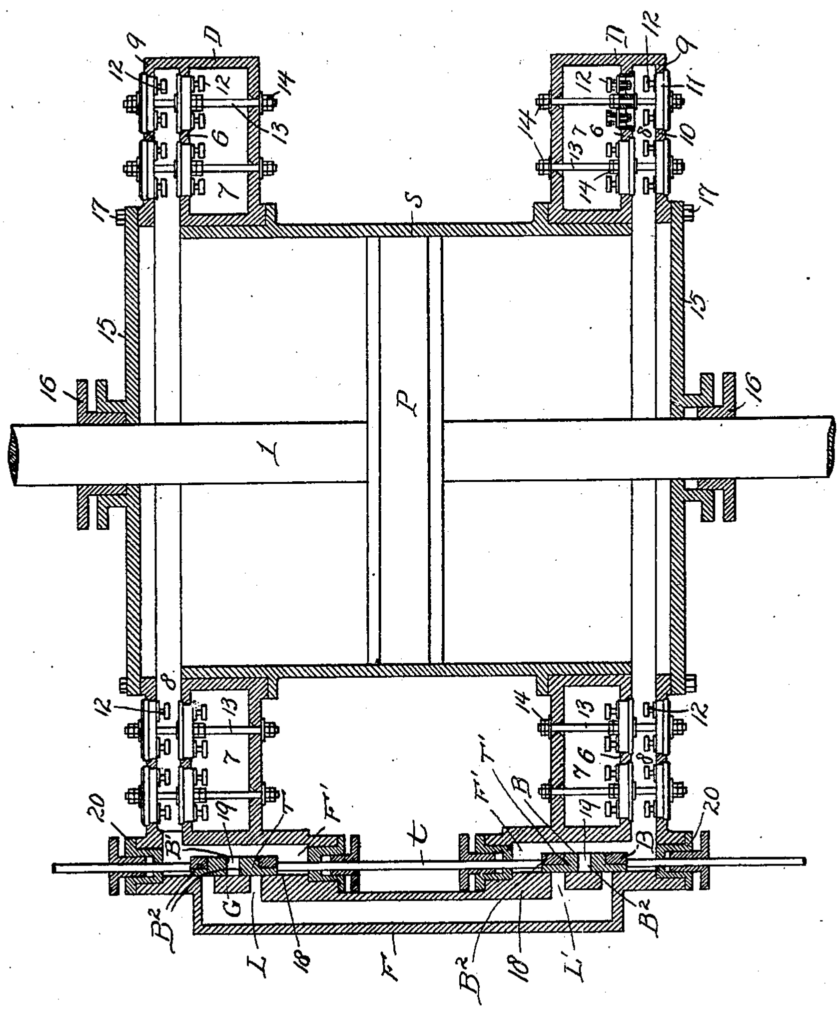

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Fig. 4.

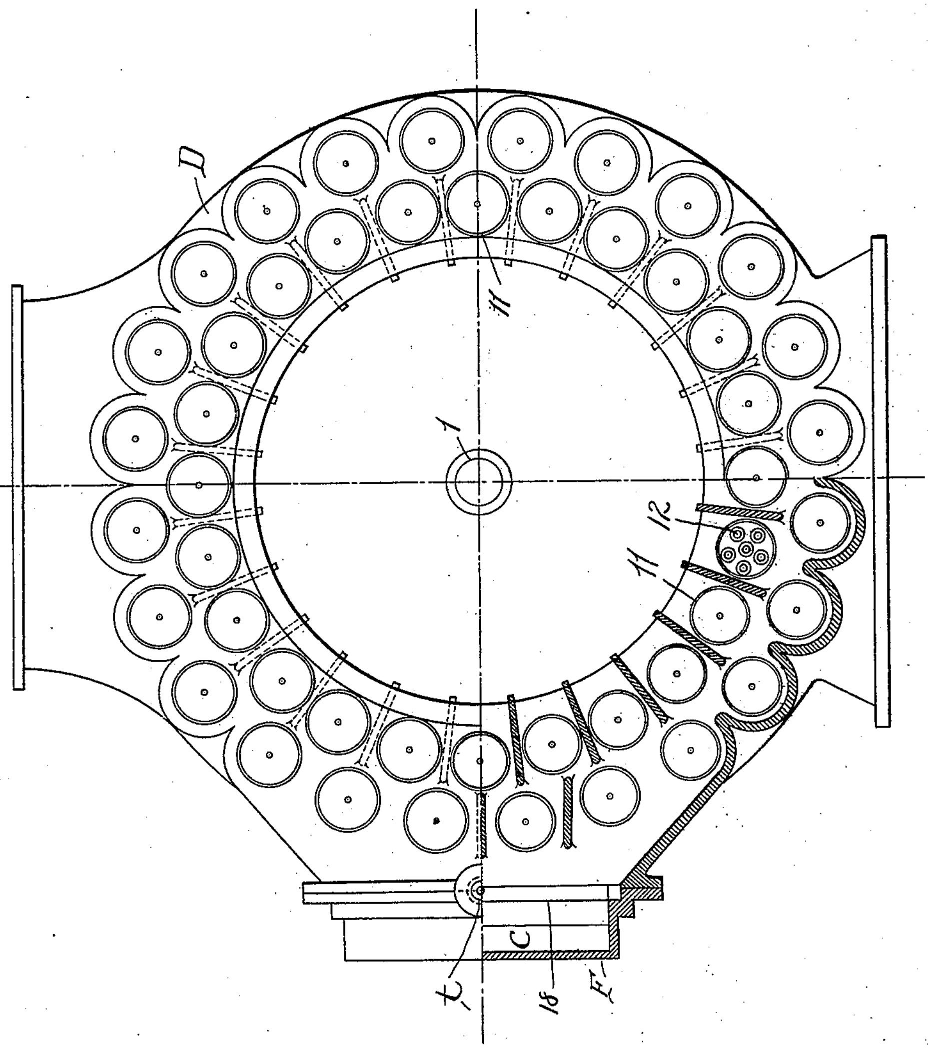

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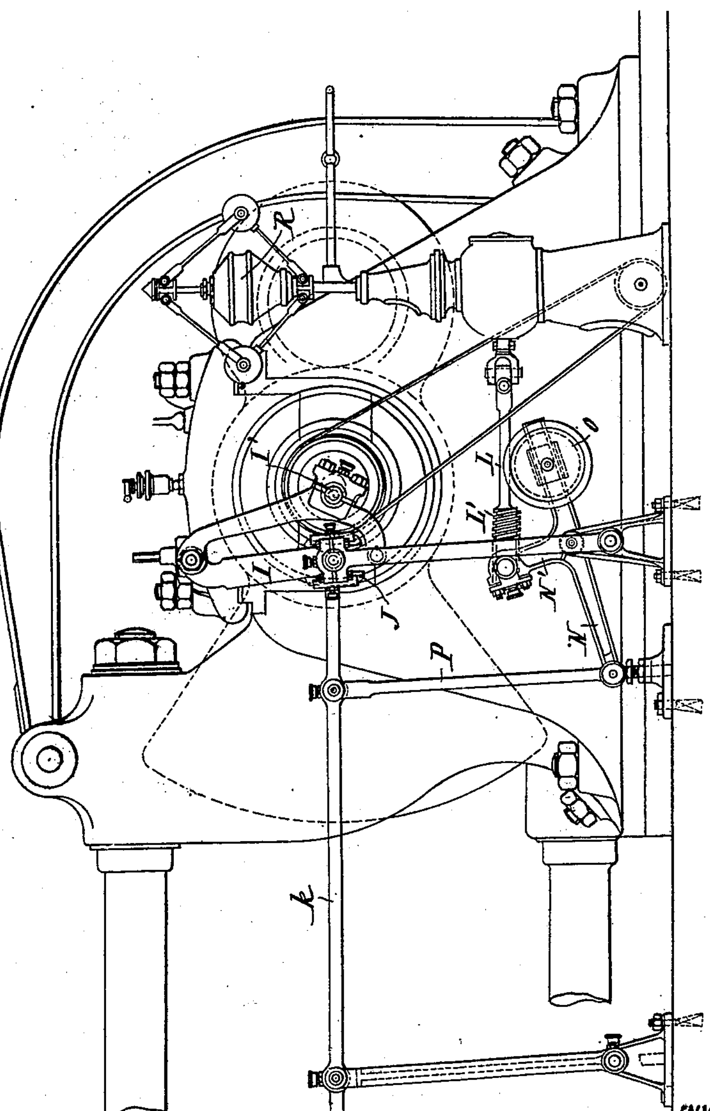
Fig. 5.



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UNITED STATES PATENT OFFICE.

ARMAND BAILLY, OF SERAING, BELGIUM.

BLOWING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 689,272, dated December 17, 1901.

Application filed June 29, 1899. Serial No. 722,319. (No model.)

To all whom it may concern:

Be it known that I, ARMAND BAILLY, a subject of the King of Belgium, residing at Seraing, in the Kingdom of Belgium, have invented new and useful Improvements in Blowing-Engines, of which the following is a specification.

This invention relates to reciprocating blowing-engines; and it consists in certain means for use in combination with the compression cylinder or cylinders, by the use of which the engine can when necessary deliver air at a higher pressure than that used in ordinary work without requiring more power from the motor or a reduction of speed. The novel apparatus by suitably retarding when required the compressive action of the blast-piston renders it non-effective during the early part of its stroke. For the remainder of the stroke the pressure of the air expelled may be higher than the ordinary working limit; but the average pressure on the piston during the full length of the stroke is maintained constant in all cases. The work performed by the blowing-cylinder remains constant, and the power developed by the motor equally so. This last condition supposes a constant speed or number of reciprocations per minute in the case (now under consideration) of gas-engines in which the power is proportional to the speed.

In the annexed drawings, Figure 1 represents a horizontal blowing-engine having one motor-cylinder and one compression-cylinder. The invention, however, is equally applicable to engines having more than one cylinder and whether vertically arranged or otherwise. Fig. 2 is a plan view of the same. Fig. 3 is an enlarged horizontal section of the compression or blowing cylinder. Fig. 4 shows an end elevation, partially in section, of the blowing-cylinder. Fig. 5 is a side view of a link-motion suitable for use with my improvements. Fig. 6 is a detail view of a modified form of governor means.

In the drawings, M is the gas-motor, which may be of any suitable construction, and S the blowing-cylinder, in which the piston P, Fig. 3, moves back and forth, the rod 1 of the said piston being connected rigidly with the end of the piston-rod 2 of the motor M, Figs. 1 and 2, by aid of a cross-beam 3, fitted with sliding blocks 4, moving in slides 5, connecting the motor-cylinder M to the blowing-cylinder S. The blowing-cylinder S is provided at each end with ring-shaped chambers D, divided into two compartments 7 8 by means of a partition 6. This partition 6 and the outer faces 9 of the chambers D are provided with holes 10, in which are placed valve-boxes 11, supporting each a number of valves 12 of ordinary construction. The valves supporting boxes 11 are held in place by means of bolts 13 and nuts 14 in the usual manner.

The compression or blowing cylinder S is closed at each end by covers 15, provided with stuffing-boxes 16, and bolted at 17 on the ring-shaped chambers D. To one side of the ring-shaped chambers D is secured a box F, forming two valve-chambers F′ F′, communicating with compartments 8 of the ring-shaped chambers D, and in which are located slide-valves T′ T′, moving upon seats G G′, formed by the inner face 18 of the box F. This face 18 of the box F is provided with ports L L′, opening in the valve-chambers F′ F′ and in the box F. The slide-valves T T′ are provided with ports 19 and are mounted on a rod *t*, passing through stuffing-boxes 20. The valves T T′ are worked by a variable cut-off gear, being in the drawing Fig. 1 a link-gear, shown at I, operated by the eccentric I′ on the crank-shaft. In the link works a sliding block J, connected by side rods K K′ to the valve-spindle *t*. The position of the sliding block J in the link I may be controlled by the governor R.

The operation of the engine is as follows: The blast-piston being reciprocated in the cylinder S through the motor M air is drawn in the cylinder at one extremity through the inlet-valves 12, located in the outer faces 9 of the chambers D, this air entering the cylinder S through compartment 8 of chamber D. The piston having completed an entire suction-stroke starts on the return or compression stroke, forcing compressed air through compartment 8 into compartment 7 of chamber D. Supposing first the pressure of the air to be normal, the engine then executes its normal number of revolutions per minute. Under these circumstances the sleeve of the centrifugal governor R, controlling the valves T T′, will remain constantly at its highest position. According to this the ports L L′ remain closed during the whole length of the piston-stroke and the air-delivery attains its maximum. Next let us suppose a higher pressure of air to be required. The engine not being able to overcome this pressure and at the same time to supply the ordinary maximum amount of air, slackens speed, causing the sleeve of the governor R to descend and impart an increased stroke to the valves T T′, which uncover the ports L L′, allowing the air to escape at the beginning of the piston-stroke. Compression can only then take place at a later moment of the piston-stroke, when the motion of the valves T T′, moving synchronously with the piston, again closes the ports L L′. While these ports remain open the work performed by the engine is *nil*, and the action of the mechanism described amounts to a virtual shortening of the blast-piston stroke corresponding to the increase of blast-pressure required. Within certain limits any extra pressure may be obtained without an appreciable reduction of the speed or (in the case of a gas-engine, as illustrated) of the power of the motor. As will be understood, when the pressure of the blast exceeds the ordinary working limit, it becomes necessary to reduce the quantity of air delivered. Supposing the blast-piston P to have completed an entire suction-stroke and the cylinder S to be full of air at the atmospheric pressure or thereabout, the piston now starts on the return or delivery stroke. At the dead-point the valves T T′ begin to uncover the ports L L′, allowing the air driven outward by the piston to escape out of the cylinder or to pass by the conduit C to the suction end of the cylinder. As the stroke of the valves is regulated by the governor R, the valve motion automatically recloses the ports L L′ at such a moment as to insure during the compression and delivery part of the stroke a mean pressure on the blast-piston corresponding to the power of the driving-motor. At this moment the sides B B′, for instance, of the valves T T′ reclose the ports L L′ and the piston P begins to compress and subsequently to deliver the air. The piston P having completed its stroke stops and returns; but at the second dead-point the valves T T′, having continued their stroke, uncover the ports L L′ by their sides B^2 B^3, and in the return stroke of the piston the cycle of operations already described is repeated, and so on.

The valves T T′ may be worked by any form of variable admission-gear, the "cutting-off" action in this case consisting in the more or less prolonged opening of the ports L L′ during the early portion of the compressive piston-stroke.

The slide-valves may be either flat, as shown, or cylindrical, and they are operated by link-gear or other motion of suitable kind, such as a mechanism of the "Meyer" adjustable cut-off type. "Corliss" valves may also be substituted, this being immaterial as regards the shortening of the effective compression-stroke, which is the object aimed at and attained in our case by the use of such mechanism. The shortening of the effective stroke may be obtained by other means than the centrifugal governor described—for example, an arrangement such as is shown in Fig. 6. This consists of a cylinder V, wherein a piston V′ is moved by the compressed air through pipe d^2 acting on one side against the force of an opposing spring W on the other side. The piston-rod V^2 is connected to the sliding block J in the guide-link I of the eccentric, and thus, as above described, the initial compression-point of the blast-piston stroke is retarded proportionately to the increase of pressure of the blast. Again, we may dispense with the governor and regulate the point of initial compression by hand; but these two latter means (viz., the air-piston and regulation by hand) are not as efficient as the centrifugal governor, for the following reasons: On stopping the engine the centrifugal governor presents the following advantage, which is a useful feature of the invention—namely, that at the moment of stoppage the blast-cylinder governor descends to its lowest position and moves the valves T T′ to open the ports L L′ during nearly the whole length of the piston-stroke, thus getting rid of all compression and reducing practically the resistance of the blast-cylinder to that simply due to friction, so that the gas-motor can easily be started again without the necessity of operating any valve, slide, or other device for relieving the engine of its load. After starting, when the speed of the motor increases and approaches the normal the blast-cylinder governor acts prior to that of the gas-motor, because the blast-cylinder governor is already at the top of its stroke when the gas-motor governor commences to act, in order to maintain the constant speed. For example, taking the normal speed to be N revolutions per minute, the governor of the blast-cylinder acts at N−n revolutions per minute—that is to say, it is at its highest position corresponding to n revolutions prior to the normal speed of the engine. Thus before arriving at the normal speed of N revolutions per minute the blast-cylinder governor rises and the valves T T′ allow the compression in the blowing-cylinder to begin at such a moment on the stroke of the piston that the engine always discharges the air at the desired pressure.

The link-motion shown in Fig. 1 is representative of any one suitable for the purpose, and it is not shown in detail, only its general features being shown. In Fig. 5 I show a link-motion suitable for use with my improvements, and this consists as follows: The centrifugal governor R acts on the intermediate shaft L, causing it to rotate, thus making the screw-thread on the extremity L′ work backward or forward in a nut carried by the arm N′ of the triple lever N. This lever raises or lowers the vertical hinged lever P and the lever k, on which last is the slide-block j, which can be placed at any height in the link I. The link I receives an oscillatory motion from an eccentric-pin I', working on the main shaft. The oscillatory motion of the link I is communicated through the jointed levers k k' to the regulating-valve, the stroke of which is thus determined by the position of the link-block J, the jointed lever k taking any inclination corresponding to that position.

I claim—

1. In combination in a blowing-engine, a cylinder and piston, inlet and outlet valves, a supplemental outlet-valve controlling a port leading from the end of the cylinder and governor means controlling the said supplemental valve to open the same during the first part of the stroke of the piston when the pressure exceeds the normal and to close the same during the final part of the stroke of the piston to allow the same to compress the air, substantially as described.

2. In combination in a blowing-engine, a cylinder and piston, inlet and outlet valves at the ends of the cylinder, a supplemental outlet-valve at each end of the cylinder, and governor means controlling the said supplemental valves, each supplemental valve, when the pressure exceeds the normal, being held open to allow the air to be discharged from the compression side of the piston at the beginning of the compression-stroke and being closed before the end of said stroke to cause the piston to compress the air in the remaining part of its stroke, substantially as described.

3. A blowing-engine comprising a cylinder, a piston moving therein, inlet and outlet valves at the ends of the cylinder, supplemental outlet-valves with means for moving said supplemental valves synchronously with the piston and closing them during all or more or less of each stroke and governor means controlling the said supplemental valves to vary the time of closing on each stroke whereby the effective or compression length of the said piston-stroke is reduced by leaving the ports open for a longer or shorter period at the beginning of the stroke when the pressure of the air-blast exceeds the normal.

4. In combination in a blowing-engine, a cylinder and piston, inlet and outlet valves at the ends of the cylinder, supplemental outlet-valves, governor means controlling said supplemental valves to open the same when the air-blast exceeds the normal pressure, said valves remaining open during only a part of the stroke of the piston and at the beginning thereof in either direction thereby reducing the length of the compression-stroke and causing the piston to compress in the final part of its stroke and a passage connecting the supplemental valves whereby the air may pass from one end of the cylinder to the other, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ARMAND BAILLY.

Witnesses:
F. KRAFT,
C. HUS.