No. 635,245. Patented Oct. 17, 1899.

G. L. VAN GINK.

ROTARY EXPANSION ENGINE.

(Application filed Dec. 20, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

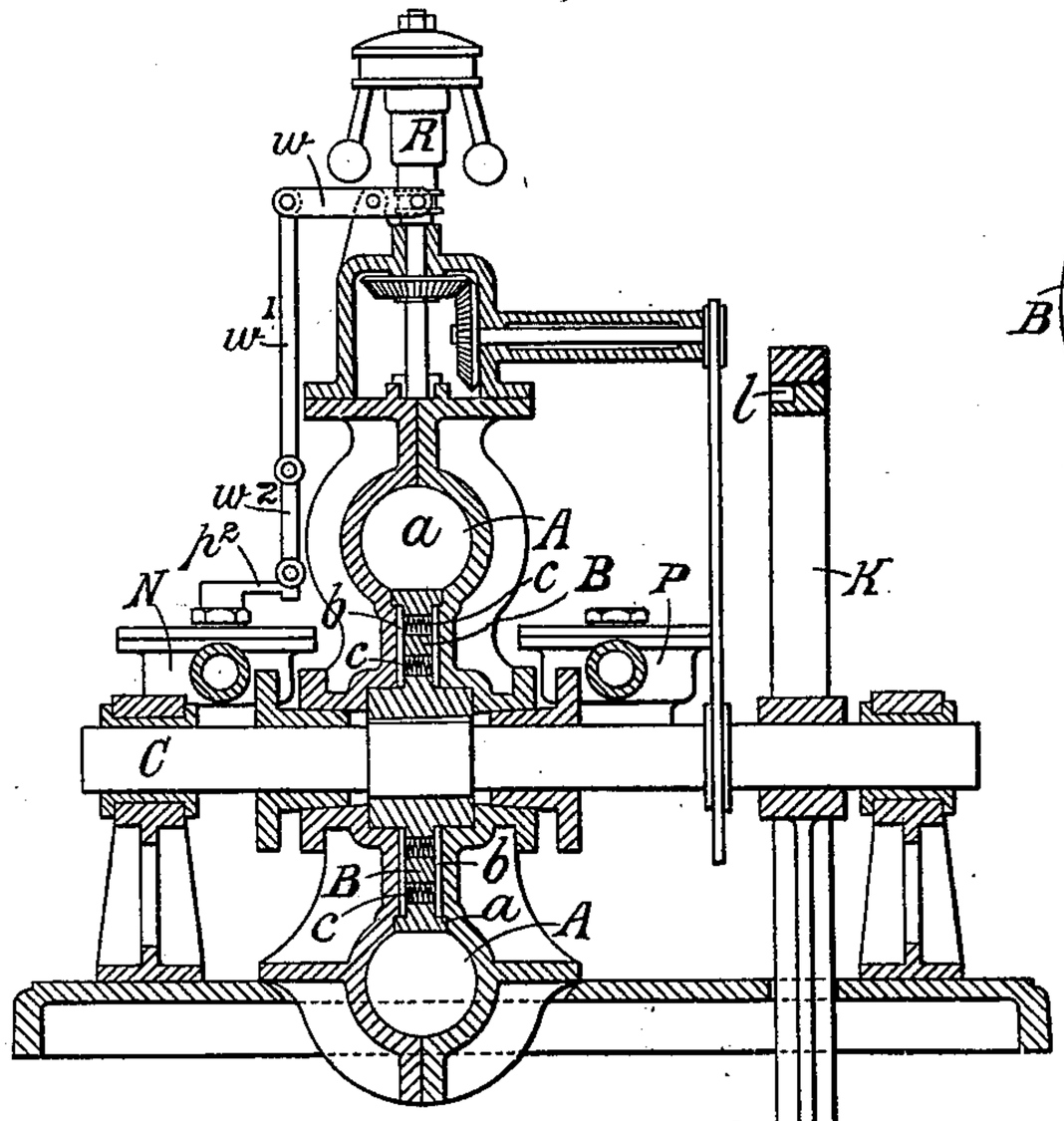


Fig. 4.

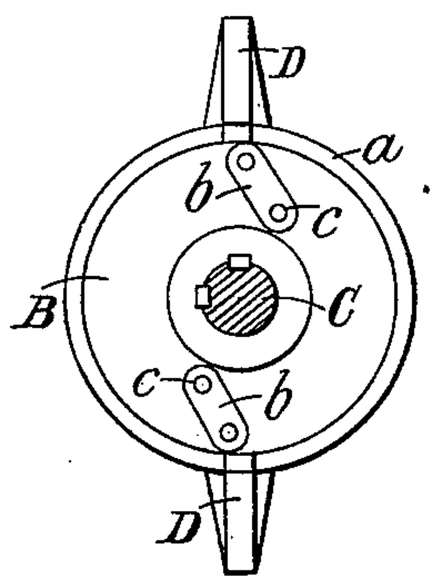


Fig. 5a.

Fig. 5b-d

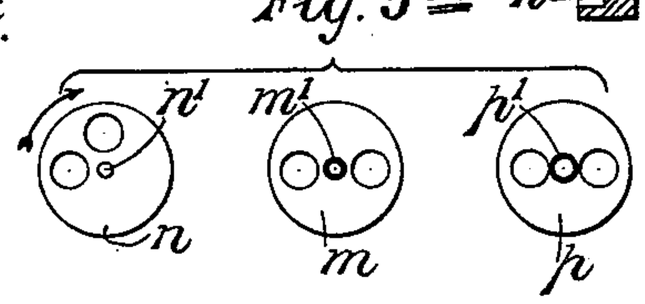
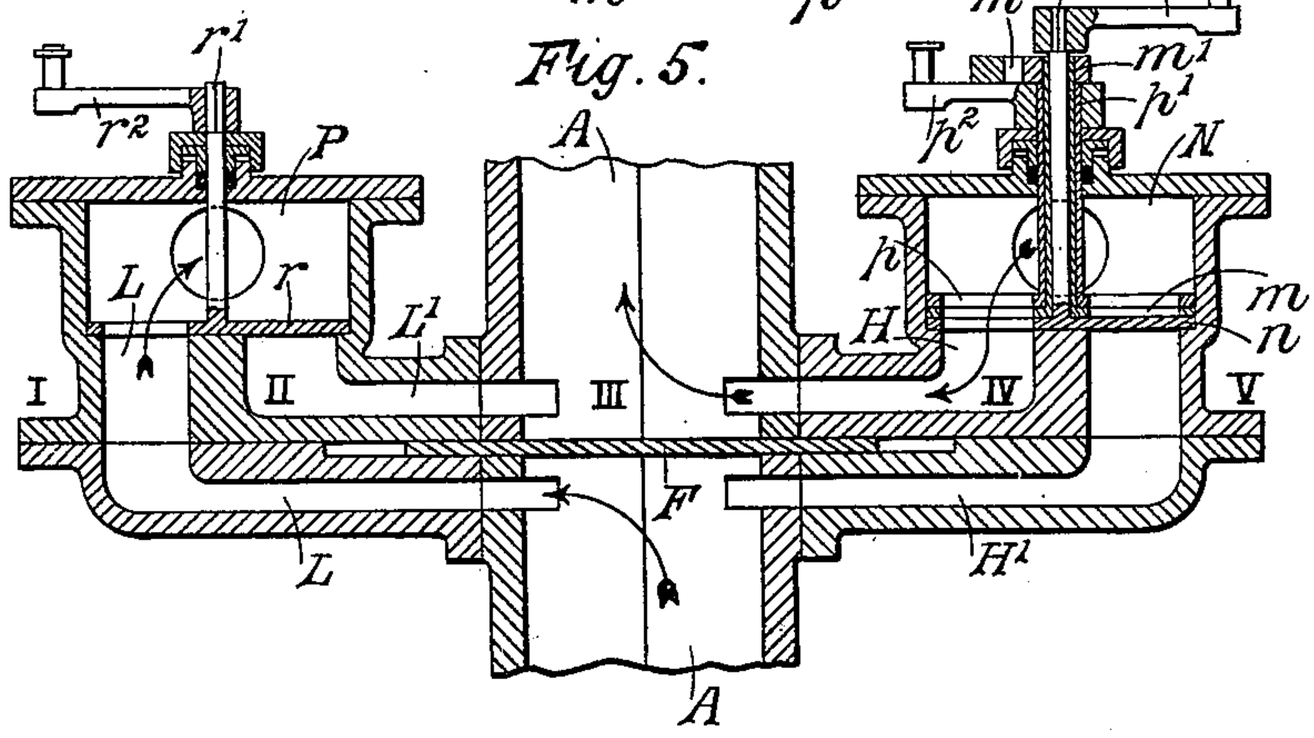


Fig. 5.



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G. L. VAN GINK.

ROTARY EXPANSION ENGINE.

(Application filed Dec. 20, 1897.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

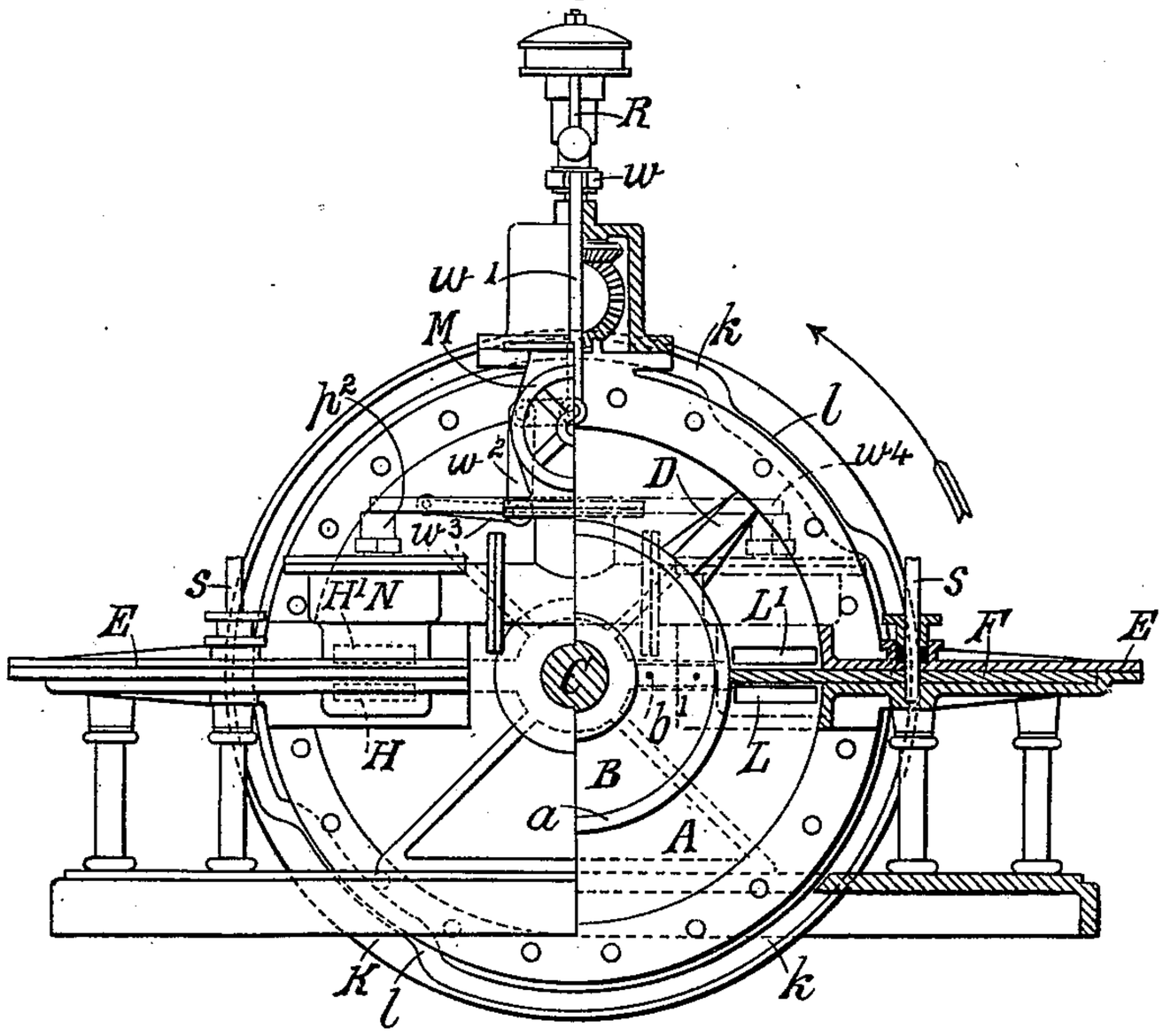
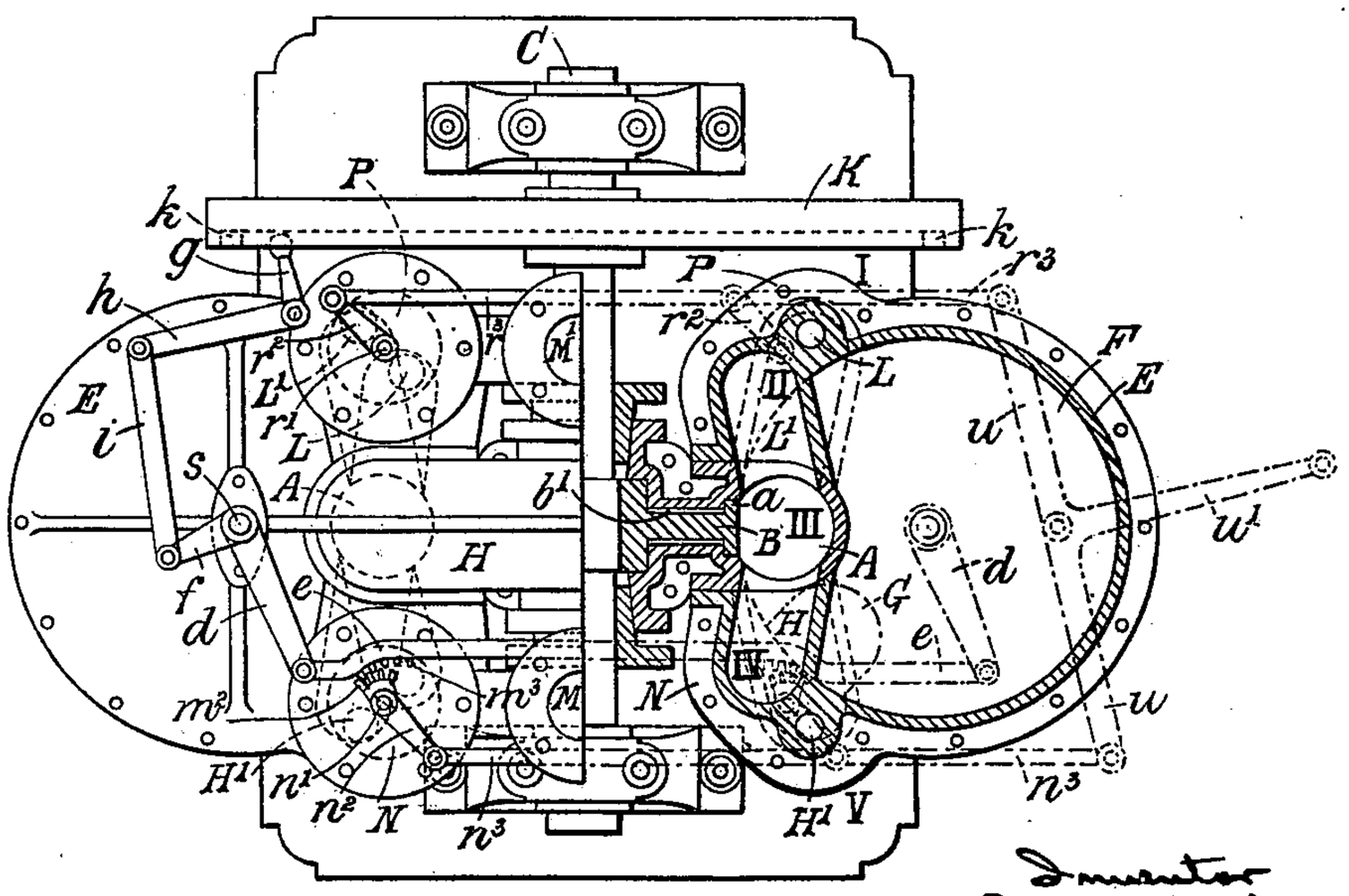


Fig. 3.



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UNITED STATES PATENT OFFICE.

GERARDUS LEONARDUS VAN GINK, OF AMSTERDAM, NETHERLANDS.

ROTARY EXPANSION-ENGINE.

SPECIFICATION forming part of Letters Patent No. 635,245, dated October 17, 1899.

Application filed December 20, 1897. Serial No. 662,666. (No model.)

To all whom it may concern:

Be it known that I, GERARDUS LEONARDUS VAN GINK, manufacturer, a subject of the Queen of the Netherlands, residing at Omval (Wÿk C) No. 70, Amsterdam, Netherlands, have invented certain new and useful Improvements in Rotary Expansion Engines or Motors, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section, Fig. 2 a side elevation, partly in transverse section, and Fig. 3 a top view or plan, partly in horizontal section, showing one form of my improved engine or motor. Fig. 4 is a side elevation of the blade or piston disk provided with two blades arranged diametrically opposite to each other. Fig. 5 is a vertical central section of the valve-chest for the admission and exhaust of the steam, drawn to an enlarged scale. Figs. 5^a and 5^b to 5^d are diagrammatic views of the steam exhaust and admission valves mounted therein.

My invention relates to rotary expansion-motors of the kind or class in which the pistons move around in an annular steam-space and are connected with a central driving-shaft.

My said invention consists, partly, in the combination of a casing, a driving-shaft extending through the same, conical recessed stuffing-boxes for centering said driving-shaft, a wheel in connection with said driving-shaft, provided on both sides in said casing with rims, whereby the water of condensation collecting behind it is caused to rotate with it, and with obliquely-arranged packing-strips, whereby said wheel is kept fluid-tight, and pistons mounted on said wheel and movable around said annular steam-space.

My said invention also partly consists in the combination of a driving-shaft, a wheel in connection with said driving-shaft, pistons mounted on said wheel and moving around said steam-space, steam-admission valve-chests and slide-valves therein, regulating and reversing gear comprising auxiliary slide-valves arranged above and beneath each of said slide-valves and provided with two steam ports or apertures, the spindles of said main and regulating valves fitting one within another around the spindles of the reversing slide-valves, the main valves controlling the admission of steam into the motor or the degree of expansion and the uppermost by the action of the governor regulating the speed of the motor, partition-slides, lever mechanism for moving the same, a toothed crown in connection with the said lever mechanism, and an eccentric toothed wheel on the valve-spindle geared with said toothed crown, whereby the steam-admission valves are operated, as hereinafter described and claimed.

In applying my invention to an engine or motor in which the blades or pistons are arranged on the periphery of a disk or wheel, as shown in Figs. 1 to 5, the ring-shaped cylinder-casing A is mounted on a bed-plate and consists of two halves or sections, between which is mounted the disk or wheel B on the shaft C, so as to turn steam-tight therein. On the circumference of the disk or wheel B are mounted two round radial blades D D opposite to one another, which move around in the ring-shaped cylinder, and consequently form the pistons of the engine.

The disk or wheel B extends only to the inner periphery of the annular chamber and has there outwardly turned or flanged rims *a*, which assist in making a steam-tight joint. Moreover, at the place where the blades D are mounted flat strips of steel *b*, Fig. 4, are arranged in an oblique direction on both sides of the disk or wheel. These strips are pressed against the flanges of the cylinder-sections by means of small spiral springs *c* or in any other suitable manner, and the said flanges are themselves provided with packing-strips *b'*, which are arranged radially at the place where the blades D pass the abutments or partitions and are also acted upon by spiral springs. Another advantageous method of rendering the disk or wheel steam-tight consists in employing packing-rings, which are laid in the outwardly-turned rims *a* of the disk or wheel B and can also be acted upon by spiral springs. The round blades or pistons are themselves made steam-tight in the cylinder or casing by means of springs, and the two cylinder-sections are formed into conical stuffing-boxes on both sides for centering the shaft C, Figs. 1 and 3, while the said shaft C is mounted on both sides in bearings on the bed-plate.

In the manner above described an absolutely steam-tight joint is also insured between the two acting parts of the cylinder.

On both sides of the cylinder or casing are arranged flat cylindrical partition-slide casings E, in which are flat slides F, mounted horizontally on a central spindle. These slides extend up to the disk or wheel B and are made steam-tight relatively thereto and are provided with an aperture or passage-way G of the size of the blades or pistons D. By moving the slides F with the apertures G in the cylinder or casing they present a clear passage-way each time when a blade or piston D is to pass, so that the blades or pistons can pass through unimpeded. The slides then immediately inclose the cylinder-compartments or working spaces again, since the opening G is again drawn back within the slide-casing E, and in this way form the rear partition for each cylinder-section or working space in which a blade or piston is driven forward by the steam-pressure.

There are as many partition-slides F as there are blades D on the disk or wheel B, and the cylinder-space is divided into a corresponding equal number of parts.

The steam admission and exhaust ports are arranged in the cylinder or casing in such a manner that for the right-handed direction of rotation of the motor, for example, the steam on the right-hand side, Fig. 2, enters through the slit H close above the partition-slide and exhausts from the other cylinder-compartment on the other side of this (the right-hand) slide—viz., at L, Figs. 2, 3, and 5. On the left-hand side the function of these openings is reversed, while for the left-handed direction of rotation H′ is the steam-admission port and L′ the exhaust-port. Before the admission of live steam the slides F of the two working spaces in the motor are again closed, and it will be seen that the motor receives two charges in each rotation for each blade or piston, consequently four charges in all.

The steam-pressure exerted on the blades or pistons sets them in rotation and is transmitted by means of the disk B to the shaft C, and by means of the arrangement described perfect balance of the motor is obtained. After the steam has exerted its pressure in one of the working spaces and has expanded in this space, the expanded or exhaust steam is forced or conveyed by means of the next blade or piston (the other) out of this space through the exhaust passage and valve into the atmosphere, the condenser, or into the receiver of compound or multiple expansion or tandem engines, according to the arrangement of the engine. These periods are repeated each time for each blade or piston.

The movement of the slides F F for permitting the passage of the blades or pistons D D through their openings G is effected in the following manner, viz: On the central spindles *s* of the slides F are mounted lever-arms *d d*, which are connected together by a rod *e*, and the left lever-arm is formed into a double lever *df*, Fig. 3. On the motor-shaft is mounted a wheel K, which is provided on one side of its periphery with a groove *k*, having two inwardly-turned parts *l l*, arranged diametrically opposite one another. In the said groove *k* plays the end of a double lever *g h*, Fig. 3, one arm *h* of which is connected to the lever-arm *f* of the left-hand slide F by means of a connecting-rod *i*. It will be seen that the end of the lever *g* is moved sidewise by the inwardly-turned part *l* of the groove *k* by means of the system of levers described each time a motion of the two slides F F takes place. The length of the said inwardly-turned part *l* is such that as soon as a blade or piston has passed the slide immediately takes up its original position again and the two working spaces of the motor are again closed. The movement of the slides F can also be effected in any other suitable manner direct from the motor-shaft, and consequently without the use of the said wheel K. In this case a box with cams or the like is arranged, for example, on the shaft.

For the sake of uniformity and good balancing, the slides F are made perfectly round. Of their surface, however, only that part is actually required which comes into the working cylinder, as well as that in which the adjacent opening G is formed. The round shape of the slides F is selected for the reason that in certain cases it may be desired to impart a rotary motion to them instead of a reciprocating motion. For this purpose one or more apertures G are provided therein, which come into the cylinder-space each time when a blade or piston is to pass. As already mentioned at the beginning of this specification, the steam admission and exhaust valves of the new motor are of special construction, and I will now more fully explain them by the aid of the accompanying drawings.

The live steam from the boiler is conducted to one side of the motor into the valve-chests N N through a stop-valve M, passes through the valve, and enters, according to the direction of rotation of the motor, through one or other set of steam-passages H H or H′ H′ into the two working spaces of the annular cylinder, Figs. 2 and 3. The steam thus acts on one side of both blades or pistons while expanding and is forced thence, by means of the blade or piston coming from the other working space, through the exhaust-passages L L or L′ L′ into the exhaust-valve chests P P, which, as can be seen from Fig. 3, are mounted on the other side of the motor and from which the exhaust passes out of the motor through a central exhaust-valve M′.

Fig. 5 shows, to an enlarged scale and in vertical transverse section on the lines I, II, III, IV, and V of the horizontal section through the valve-casing in Fig. 3, the arrangement of the valve-chests N and P and the passages H H′ and L L′, together with the annular working cylinder A, lying between

them and the slides F. By means of these figures the passage of the steam through the motor can be easily understood, and for the right-handed rotation of the motor-shaft (in the direction of the arrow in Fig. 2) the steam passes through the passage H above the slide F at the right-hand side into the upper working space and on the left-hand side beneath the slide F into the lower working space and escapes as exhaust-steam through the exhaust-passage L of the upper working space at the left-hand side above and in the lower working space on the right-hand side beneath the slide F. (See the arrow in Fig. 5.) For the left-handed rotation of the motor-shaft, on the other hand, the steam passes through the passage H′ to the left-hand side above the slide in the upper and to the right-hand side beneath the slide in the lower working space and escapes through the passage L′ of the upper working space to the right-hand side above and to the lower working space at the left-hand side beneath the slide F.

The reversal of the direction of rotation and the regulation of the live and exhaust steam in the motor are effected by means of the valve shown in Figs. 5, 5ª, and 5ᵇ to 5ᵈ. In the valve-chests N N and P P are arranged flat valves on vertical spindles and in the steam-admission valve-chests N N three valve-disks n, m, and p, one above another, the spindles n', m', and p' of which are arranged sleeve-like one around another, and in the steam-exhaust valve-chests there is another valve-disk r. In each of these valve-disks are formed two round holes which in the normal position of the valve-disks, as shown in Figs. 5, 5ª, and 5ᵇ to 5ᵈ, coincide with the passages for the live and exhaust steam H and L or H′ and L′ in the bottom of the valve-chest. The lowermost valve-disk n in each of the two steam-admission valve-chests N N and the valve-disk r in each of the steam-exhaust valve-chests P P serve for reversing the direction of rotation. For this purpose a lever-arm n^2 r^2 is mounted on each of the valve-spindles n' r', these arms being connected by means of connecting-rods n^3 r^3 to a reversing-lever u u'. By operating the lever u' the disk-valves n and r are turned through an angle of ninety degrees, and then instead of one set of the steam-admission or steam-exhaust passages H and L the other set of passages H′ and L′ is opened. In this manner since the two valves n n for the admission of steam and those r r for the exhaust are connected to one system of levers the reversal thereof for another direction of rotation of the motor is simultaneously effected. During the driving of the motor both valves n and r stand completely open, as does also the steam-exhaust valve. By means of these valves by turning the reversing-lever u u' through an angle of one hundred and eighty degrees the motor can be immediately brought to rest. The second valve-disk m in the admission valve-chest N N, Figs. 5 and 5ᶜ, regulates the admission of live steam into the working space. This valve consequently permits live steam each time to enter the passage H H or shuts it off. The piston disk or wheel is also provided with two holes arranged diametrically opposite one another, so that they can partly close either of the admission-passages H or the passage H′, according to the direction of rotation of the motor-shaft. In the drawings, Fig. 5, the passage H is shown opened for the live steam, and the steam can enter continuously until one-tenth before the end of the stroke unless the governor does not act in the meantime. The rotation of this valve-disk is effected by means of the eccentric toothed wheel m^2, mounted on its spindle m', this toothed wheel being in gear with a toothed crown m^3, which is arranged in the bend of the connecting-rod e for the slide-valve motion, Fig. 3. The toothed wheel must therefore be eccentric, since this connecting-rod e does not move in a straight line. The motion mechanism for the slides F accordingly also actuates the two valves m m in the steam-admission valve-chests N N, and these are so mounted that immediately after the opening G in the slide F is again drawn back, and consequently immediately after the blade or piston D has passed through, the said valves m m are opened and live steam is admitted into the motor. The third (uppermost) valve-disk p, Figs. 5 and 5ᵈ, is also provided with two diametrically opposite holes. This disk is operated by the action of the governor R by means of lever mechanism, which consists of the lever-arm w, connecting-rod w', knee-lever w^2, and another connecting-rod w^3, which engages with the lever-arm p^2 of the valve p. The two lever-arms p^2 are again connected together by a connecting-rod w^4, so that both valves m in the steam-admission valve-chests N N are operated at the same time. Rotation of this disk reduces for both directions of rotation the ports or openings in the steam-admission valve-disk m, arranged beneath it, and in this manner regulates the speed of the motor, since it more or less closes the steam-admission port. The governor R is driven in the usual manner from the motor-shaft, as shown in Fig. 1.

The motor can be provided with one, two, or more blades or pistons and the exhaust conveyed from the motor into the receiver of a single, compound, or multiple expansion or tandem engine, as above mentioned. In the single expansion-engine, however, the arrangement of two blades or pistons is the most advantageous.

Instead of steam the motor can also be driven by any other pressure medium, in which, however, there are no alterations in the arrangement of the blades or pistons D and the disks or slides F and only unessential modifications of the valves.

This motor is also capable of being used as a multiple expansion-engine. It can be made with one, two, or several blades and can be

driven by another working fluid or medium without necessitating any essential alteration in its construction.

What I claim is—

1. In combination, in a motor having an annular steam-space, a casing, a driving-shaft extending through the same, conical recessed stuffing-boxes for centering said driving-shaft, a wheel in connection with said driving-shaft, provided on both sides in said casing with rims whereby the water of condensation collecting behind it is caused to rotate with it, and with obliquely-arranged packing-strips whereby said wheel is kept fluid-tight, pistons mounted on said wheel and movable around said annular steam-space, partition-slides moving transversely to the pistons, steam and exhaust valve-chests, rotary valves therein having openings for reversing the direction of rotation of the motor, which openings correspond with ports or passages opening into the cylinder-spaces above and below the partition-slides, lever-arms and links connecting together the spindles or axes of said slide-valves and a hand reversing-gear for operating said valves, substantially as, and for the purposes, hereinbefore described.

2. In combination, in a motor having an annular steam-space, a driving-shaft, a wheel in connection with said driving-shaft, piston mounted on said wheel and moving around said steam-space, steam-admission valve-chests and slide-valves therein, regulating and reversing gear comprising auxiliary slide-valves arranged above and beneath each of said slide-valves and provided with two steam ports or apertures, the spindles of said main and regulating valves fitting one within another around the spindles of the reversing slide-valves, the main valves controlling the admission of steam into the motor or the degree of expansion, and the uppermost, by the action of the governor, regulating the speed of the motor, partition-slides, lever mechanism for moving the same, a toothed crown in connection with the said lever mechanism, and an eccentric toothed wheel on the valve-spindle geared with said toothed crown whereby the steam-admission valves are operated, substantially as described.

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

GERARDUS LEONARDUS VAN GINK.

Witnesses:

ANTONIE DOYER,

AUGUST SOCYFRIED DOCEN.