N° 15,623 A.D. 1910

Date of Application, 29th June, 1910

Complete Specification Left, 30th Jan., 1911—Accepted, 29th June, 1911

PROVISIONAL SPECIFICATION.

Improvements in and relating to Rotary Internal Combustion Engines.

I, FREDERICK LAMPLOUGH, of The Albany Works, Cumberland Park, Willesden Junction, in the County of Middlesex, Managing Director, do hereby declare the nature of this invention to be as follows:—

The invention relates to that type of rotary internal combustion engine in which segmental pistons are arranged within an annular chamber and are caused alternately to approach and recede from each other and in doing so give rotary motion to the shaft, and the present invention consists of a novel arrangement and combination of parts whereby the working of the engine is improved and the pistons are kept cool.

My improved engine is constructed somewhat in the following manner:—

The shaft is placed eccentrically within a sleeve forming the inner wall of an annular chamber, the outer wall of which is formed by the inner surface of a fixed water-cooled cylinder. This annular chamber is fitted with a number of segmental pistons, four or more, which alternately approach and recede from each other and in doing so give rotary motion to the shaft by the following arrangement:—

Each piston has a hole bored at each end and within such holes are fitted hollow pins formed on rings which are free to oscillate in end plates which are rigidly keyed to the shaft.

Owing to the eccentricity of the sleeve with the shaft, an accelerating motion is imparted to the pistons for half the stroke and a retarding motion for the other half; the consequence is that at diametrically opposite points the maximum opening and closing of the spaces between the ends of the pistons is obtained.

The charging pump consists of an arrangement of parts closely resembling those of the engine; an air chamber is formed between the engine casing and the pump casing and the engine shaft is continued through the pump and gives motion to the pump pistons by means of end plates keyed to the shaft, rings oscillating in said end plates, and pins on said rings entering holes bored in the ends of the pistons. These latter pins, however, have no free way through them and the eccentric sleeve and cylinder are arranged on diametrically opposite sides of the engine shaft to those parts of the engine.

The hollow pins entering the ends of the engine pistons effect a very important function with regard to the cooling of the engine. By means of the pump pistons, which are proportionately longer than the engine pistons according to the amount of compression desired, a pumping action is brought about, the charge is drawn through an opening in the end cover of the engine, through the hollow pins of the oscillating discs and through the engine pistons into the intermediate air or gas chamber, whence it passes into the charging pump through a port at one end thereof and partly around the same. The charge is then transferred in a compressed state through another port on the pump cylinder, through

[*Price* 8*d*.]

a pipe leading to a port in the engine casing ready for admission to the space between the ends of two pistons as they cross the port.

As these pistons travel on, one of them closes the charging port; the charge is then in a compressed state between them ready for firing by means of a firing plug inserted in an opening in the casing; the space in which the previous charge was fired is just opening into the exhaust space, whence it passes to the atmosphere through a silencer, as usual, and at such time, where four pistons are used, the third space between the pistons will be exhausting and the fourth quite exhausted.

As the piston mentioned as closing the charging port, passes said port, a further charge will pass into the space between it and the next following piston; consequently the action is practically continuous, there being four explosions per revolution, but in larger engines where a greater number of pistons are employed, a greater number of explosions take place per revolution.

The pistons are kept tight in the following manner:—

U-shaped pieces of suitable metal are inserted in recesses along the whole length of the pistons on their inner concave surface and on their outer convex surface.

The ends of the pistons are fitted with similar pieces; the consequence is that as the pressure comes on either side of the pistons it flows between the U-shaped pieces and blows one side out tightly against the cylinder, pressing the other tightly against the piston, whilst the ends of the pistons are sealed by their U-shaped pieces being blown tightly against them and their end plates. These end plates are adjusted by nuts and lock nuts screwing on to the shaft and locking rings having a tongue on either side engaging with slots in the shaft; the lock nut is in turn secured by means of a lock nut washer, as described in the Specification of Patent No. 27,870 of the year 1908, or by other suitable means. The adjustment takes place between a collar on the engine shaft outside the engine removable end cover and the locking arrangement, which latter is located in the intermediate air chamber.

That part of the engine shaft passing through the pump is provided with a similar arrangement for tightening up the pump end plates, but in this case, as this end of the shaft can have no collar, a double set of locking nuts and co-acting parts is employed.

The lubrication is effected by a pump on that end of the engine shaft projecting beyond the pump body.

To prevent air being drawn in through the bearing on the engine removable end cover, a corrugated diaphragm is fitted outside said bearing and this is drawn by the suction tightly against the collar on the engine shaft.

The ends of the pistons of the engine and pump are fitted with rings rotating therewith which are preferably located in recesses bored in the cylinders, thereby preventing excessive friction at high speeds between the pistons and the cylinder walls.

The pistons are recessed on each edge of their outer surface for the purpose of making the intermediate part correspond with the charging port. This part of the pistons is only slightly wider than is necessary to bridge the said port, the remaining parts of the pistons bear on the cylinder and retaining rings.

The charging of the motor may be effected in either of the following ways, that is to say, by carburetting the air drawn through the engine pistons with light or heavy hydrocarbon before entering the pistons or after it has left the pump or on its way to the firing cylinder or by a spray or a force pump.

Dated this 29th day of June, 1910.

HARRIS & MILLS,
23, Southampton Buildings, London, W.C., and at
Sheffield & Llanelly,
Agents.

COMPLETE SPECIFICATION.

Improvements in and relating to Rotary Internal Combustion Engines.

I, FREDERICK LAMPLOUGH, of The Albany Works, Cumberland Park, Willesden Junction, in the County of Middlesex, Managing Director, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to internal combustion engines of the type in which segmental pistons are arranged within an annular chamber so that during rotation they alternately approach and recede from each other.

In such engines two similar mechanisms of this type are mounted about a common rotating shaft, the one mechanism being employed as a compressor to compress the charge which is then delivered into the other mechanism where it is ignited and explodes.

In such engines the explosive mixture is admitted into the space between the pistons of the compressor mechanism when this space is large, and is carried round and delivered to the motor with reduced volume and increased pressure, and is admitted into the space between the pistons of the motor mechanism when such space is small and is ignited, thus causing the space to expand, thereby driving the pistons apart and causing the motor mechanism to rotate. The compressor is on the same shaft as the motor and is direct driven thereby. According to this invention, in order to cool the motor pistons, the charge is drawn through them, and for this purpose it is desirable to employ that form of mechanism for the compressor and motor which has been described by me in a patent of earlier date, namely, No. 14,828 of 1910, and in the detailed description which follows, the invention is described with reference to this particular form of mechanism.

It is advantageous to employ an intermediate container to store the air or charge before admission to the compressor, as is hereinafter described.

The motor and compressor cylinders are preferably arranged on diametrically opposite sides of the shaft.

I will describe my invention by the aid of the accompanying drawings, in which:—

Fig. 1 is a longitudinal section of my improved internal combustion engine with some parts omitted.

Figs. 2 and 3 are cross sections drawn respectively on the lines 2—2, 3—3, of Fig. 1.

Fig. 4 is an end view and Fig. 5 a plan of one of the motor pistons.

Fig. 6 is an elevation and Fig. 7 a plan of one of the motor driving plates.

Fig. 8 is an elevation and Fig. 9 a plan of one of the compressor driving plates.

Fig. 10 is an elevation and Fig. 11 a horizontal section of one of the motor driving rings or discs.

Fig. 12 is an elevation and Fig. 13 a horizontal section of one of the compressor driving rings or discs, and

Figs. 14 to 21 are detail views of means employed in adjusting and locking the motor and compressor driving plates.

The motor mechanism is preferably constructed as follows:—

The shaft *a* is placed eccentrically within a sleeve *b* forming the inner wall of an annular chamber, the outer wall of which is formed by the inner surface of a fixed water-cooled cylinder *c*. This annular chamber is fitted with a number of segmental pistons *d*, which alternately approach and recede from each other, and in doing so give rotary motion to the shaft *a*; any suitable number of pistons

may be employed, but I have shown a design in which the number of pistons in each mechanism is four.

Each piston d has a hole d^1 bored at each end, and within such holes are fitted hollow pins e^1 formed on hollow rings or discs e, which are free to oscillate in driving end plates f, which are keyed to the shaft so as to rotate the same, but which can slide thereon for adjustment.

Owing to the eccentricity of the sleeve b with the shaft a, the pistons d are compelled to move with an accelerating motion for half the stroke and a retarding motion for the other half; the consequence is that, at diametrically opposite points, the maximum opening and closing of the spaces between the ends of the pistons d is obtained.

The compressor consists of an arrangement of parts closely resembling those of the motor, b^* being the sleeve through which the shaft a passes, c^* the cylinder, d^* pistons, e^* a ring or disc, e^{1*} a pin on said ring or disc e^*, which pin enters a hole d^{1*} bored in a piston, f^* is one of the compressor driving plates. A container g is formed between the motor casing and the compressor casing, and the motor shaft a is continued through the compressor and gives motion to the compressor piston d^* by means of driving end plates f^* keyed to the shaft a so as to rotate therewith but capable of sliding thereon. e^* are rings or discs oscillating in said end plates f^*, and pins e^{1*} on said rings or discs enter holes d^{1*} bored in the ends of the pistons d^*. These latter pins e^{1*}, however, may have no free way through them and the eccentric sleeve b^* and cylinder c^* are preferably arranged on diametrically opposite sides of the shaft to those parts of the motor.

The discs or rings e and e^*, on their inner faces, form a continuous surface with the end plates f and f^*.

The hollow pins e^1 entering the ends of the motor piston d, effect a very important function with regard to the cooling of the motor. By means of the compressor pistons d^*, which are proportionately longer than the motor piston d, according to the amount of compression desired, a pumping action is brought about, the charge is drawn through an opening c^2 in the end cover c^1 of the motor, through the hollow pins e^1 of the oscillating rings or discs e, and through the pistons d, into the intermediate container g, whence it passes into the compressor through a port h at one end thereof and partly around the same. The charge is then transferred in a compressed state through another port i, through a pipe, not shown, leading to a port j in the motor casing, ready for admission to the space between the ends of two pistons d as they cross the port j.

As these pistons d travel on, one of them closes the charging port j; the charge is then in a compressed state between them, ready for firing by means of a firing plug inserted in an opening k in the casing. At the same time, the space in which the previous charge was fired is just opening into the exhaust space l, whence it passes to the atmosphere through a silencer, as usual, and at such time, where four pistons are used, the third space between the pistons will be exhausting and the fourth quite exhausted.

As the piston d mentioned as closing the charging port j, passes said port, a further charge will pass into the space between it and the next following piston; consequently the action is practically continuous, there being four explosions per revolution, but in larger engines, where a greater number of pistons are employed, a greater number of explosions take place per revolution.

The pistons d may be kept tight in the following manner:—

U-shaped pieces m of suitable metal are inserted in recesses along the whole length of the pistons d on their inner concave surfaces and on their outer convex surface.

The ends of the pistons are fitted with similar pieces m. The consequence is that, as the pressure comes on the pistons, it acts between the U-shaped pieces m and blows one side out tightly against the cylinder c and the sleeve b, pressing the other side tightly against the piston d, whilst the ends of the pistons d are sealed by their U-shaped pieces m being blown tightly against them and

their driving end plates *f*. The adjustment of the end plates may be effected as follows:—

Nuts *n* and lock nuts *o* screw onto the shaft *a*, and locking rings *p*, having a tongue p^1 on either side, engage with slots a^1 in the shaft *a*, and having lateral teeth p^2 on the outer edge which engage with recesses n^1 on the outer edge of the nut *n*. The lock nut *o* is in turn secured by means of a lock nut washer *q* having a tongue q^1 which enters one of the grooves a^1 of the shaft *a*, which tongue q^1 is bent over into one of the notches o^1 in the lock nut *o*, as described in the Specification of Patent No. 27,870 of the year 1908, or by other suitable means.

The adjustment thus takes place between a collar a^2 on the motor shaft *a*, outside the removable end cover a^1, and the locking arrangement, above described, which latter is located in the intermediate chamber or container *g*.

That part of the shaft *a* which passes through the compressor, is provided with a similar arrangement for tightening up the compressor driving end plates *f**, but in this case, as this end of the shaft can have no collar, a double set of locking nuts and co-acting parts is employed, those at the inner end of such part of the shaft alone being shown in the drawing.

The lubrication is effected by a pump on that end of the shaft projecting beyond the compressor body, as will be readily understood.

To prevent air being drawn in through the bearing on the removable end cover c^1 of the motor, a corrugated diaphragm *r* is fitted outside said bearing, and this is drawn by the suction tightly against the collar a^2 on the shaft *a*.

The ends of the pistons *d*, *d**, of the motor and compressor are fitted with rings *s* rotating therewith, which are preferably located on recesses c^3 bored in the cylinder, thereby preventing excessive friction at high speeds between the pistons and the cylinder walls.

The pistons are recessed at *t* on each edge of their outer surface for the purpose of making the intermediate part correspond with the charging ports *i* and *j*. This part of the pistons is only slightly wider than is necessary to bridge the said ports; the remaining parts of the pistons bear on the cylinders *c* and *c**, sleeves *b* and *b**, and retaining rings *s*.

The formation of the mixture may be effected in any suitable way, as, for example, by carburetting the air with light or heavy hydrocarbon, before it is drawn into the pistons, or after it has left the compressor, or on its way to the motor, or the mixture may be formed by a spray or a force pump delivering the hydrocarbon in suitable or measured quantities.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An improved rotary internal combustion engine comprising a compressor and a motor mounted on a common shaft, both the compressor and the motor having an annular chamber eccentric to the shaft and containing rotating segmental pistons which alternately approach and recede from one another, the motor pistons giving motion to the shaft and the compressor pistons receiving motion therefrom, the two annular chambers being arranged on diametrically opposite sides of the shaft, as shown and described.

2. An improved rotary internal combustion engine comprising a compressor drawing air or mixture from a container and delivering it under pressure to a motor, the compressor and motor being mounted around the same shaft but on opposite sides thereof and having rotating segmental pistons which alternately approach and recede from one another.

3. In a rotary internal combustion engine of the type claimed in Claim 1, means for cooling the motor pistons, characterized by the fact that the air or mixture passes through the interior of the hollow motor pistons before it is admitted to the motor, substantially as described.

Improvements in and relating to Rotary Internal Combustion Engines.

4. An improved rotary internal combustion engine in which the charge is drawn through the hollow pistons of the motor and through a container into the compressor and is there compressed between rotating segmental pistons and is delivered to a motor where it explodes between rotating segmental pistons, substantially as described.

5. In internal combustion engines of the type described, means for rendering the motor pistons gas-tight consisting in U-shaped packing pieces inserted in recesses in the surface of the said pistons along their line of contact with the internal surfaces and ends of the containing annular chamber, substantially as described.

Dated this 30th day of January, 1911.

HARRIS & MILLS,
Agents.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1911.

Fig. 1

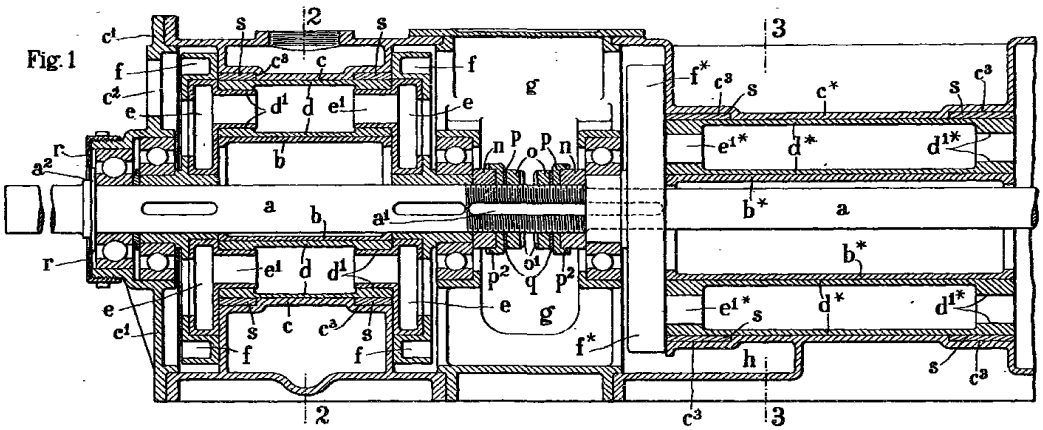


Fig. 2

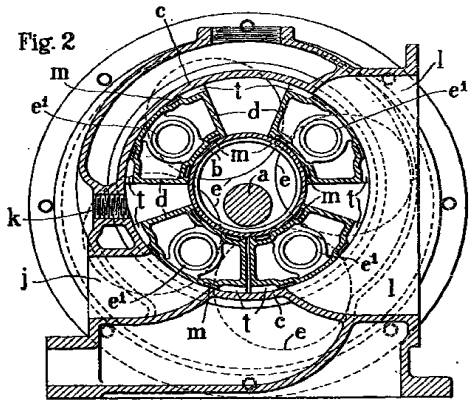
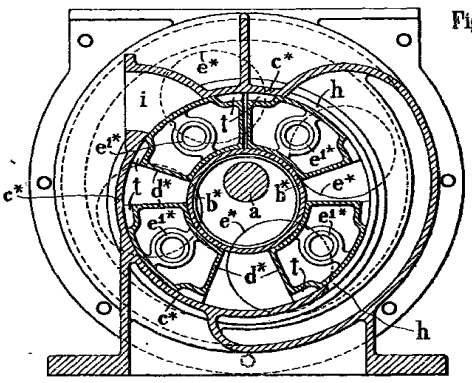


Fig. 3



Malby&Sons, Photo-Litho

Fig. 1

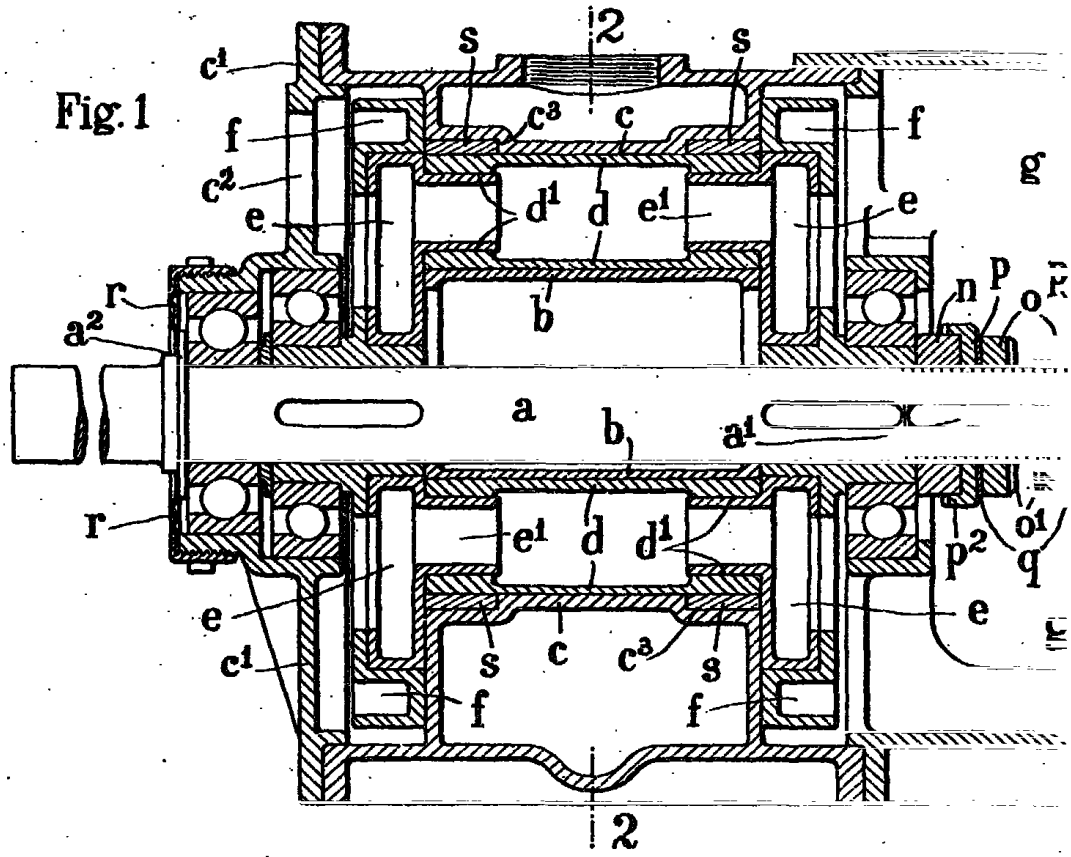
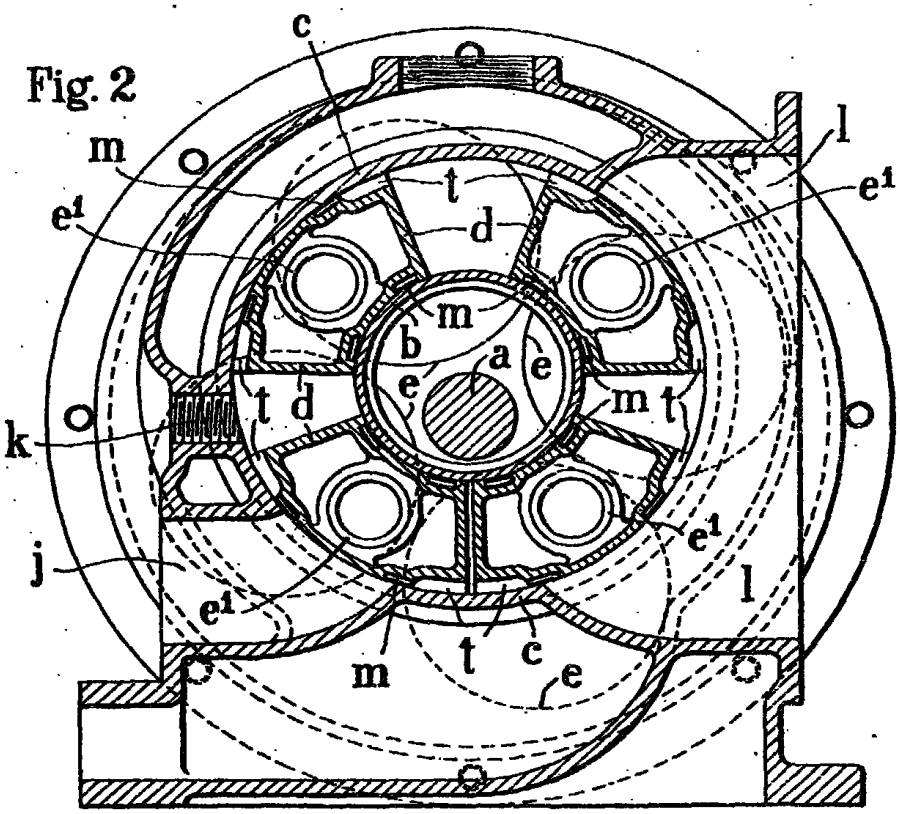
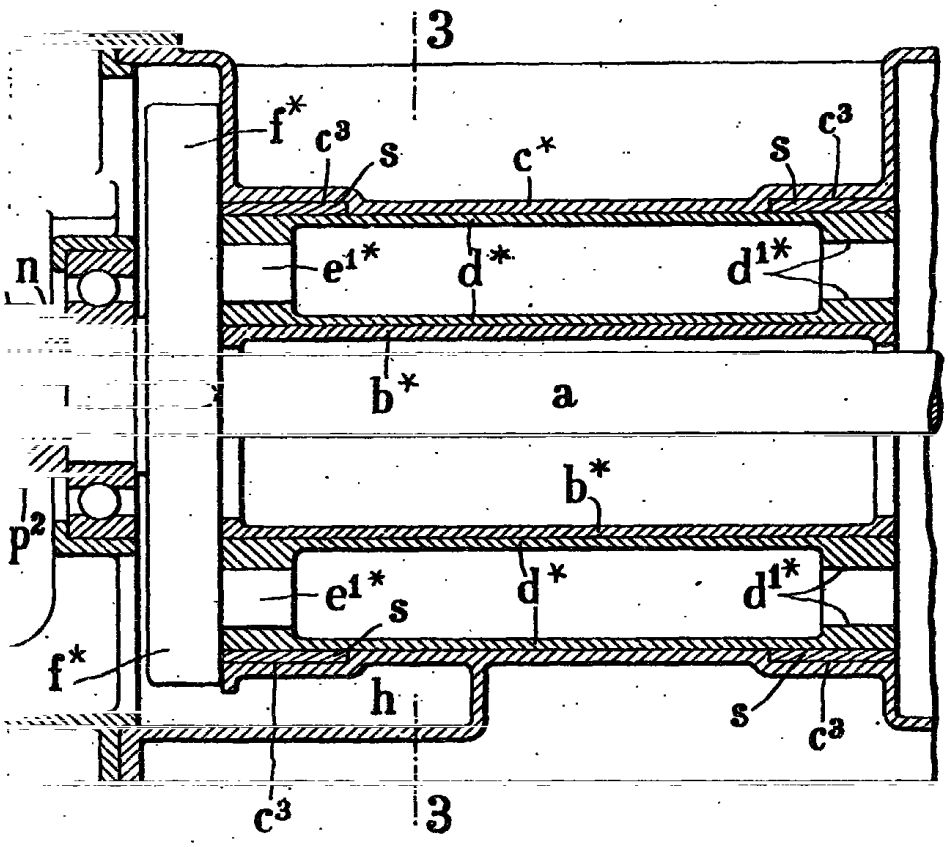


Fig. 2





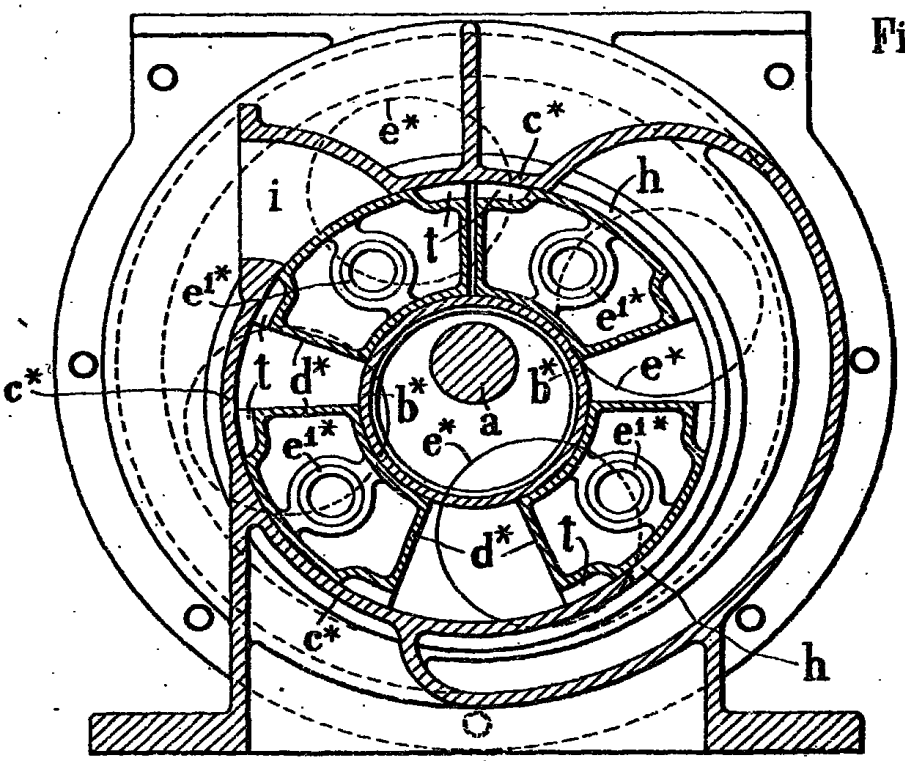


Fig. 3

Malby&Sons, Photo-Litho.

A.D. 1910. JUNE 29. No. 15,623.
LAMPLOUGH'S COMPLETE SPECIFICATION.

(3 SHEETS)

SHEET 2

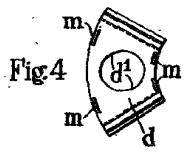


Fig.4

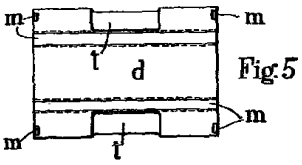


Fig.5

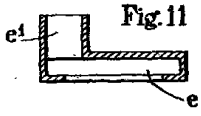


Fig.11

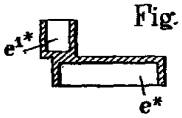


Fig.13

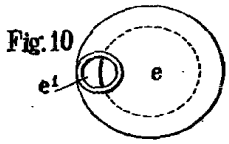


Fig.10

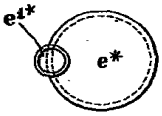


Fig.12

Fig.14

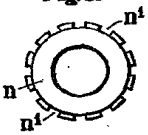


Fig.15

Fig.16

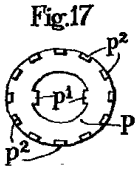


Fig.17

Fig.18

Fig.19

Fig.20

Fig.21

SHEET 3

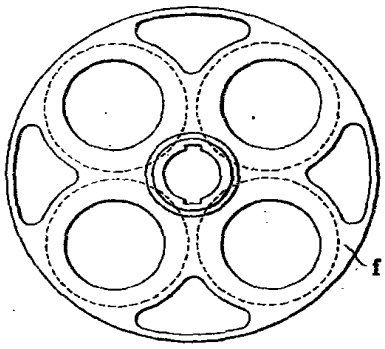


Fig.6

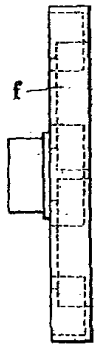


Fig.7

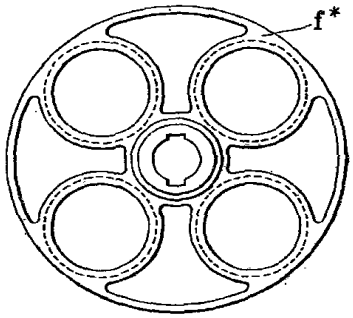


Fig.8

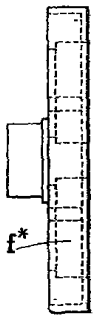


Fig.9

Malby&Sons, Photo-Litho.

Fig.4

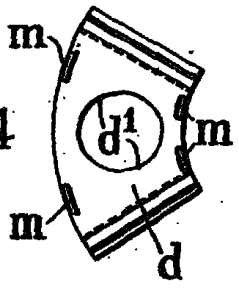


Fig.5

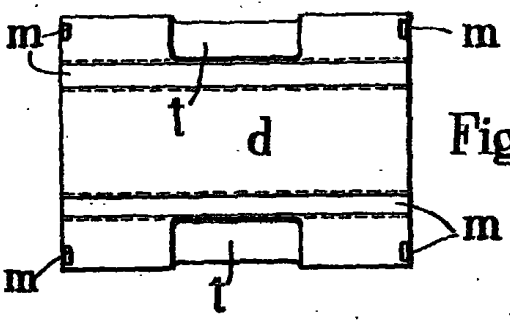


Fig.11

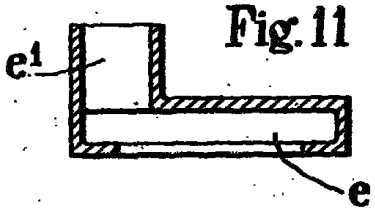


Fig.13

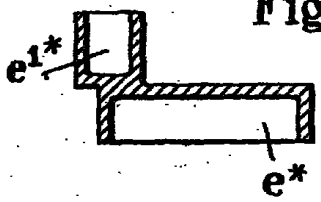


Fig.10

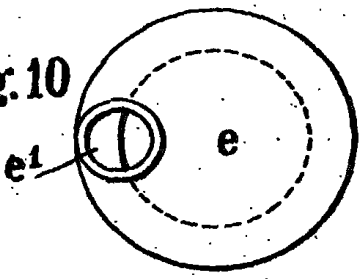


Fig.12

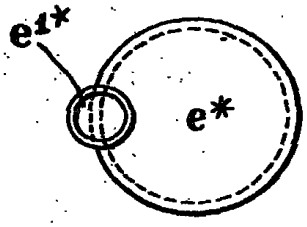


Fig.14

Fig.15

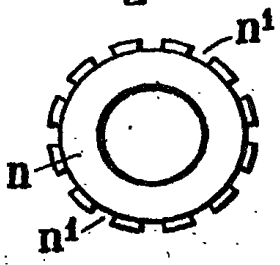


Fig.16

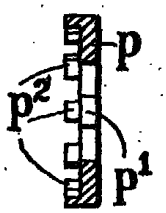


Fig.17

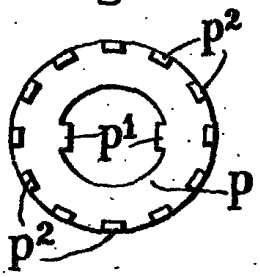


Fig.18

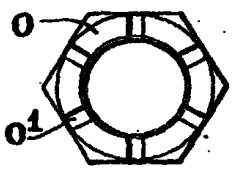


Fig.19

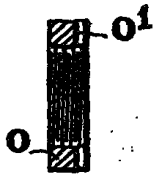


Fig.20

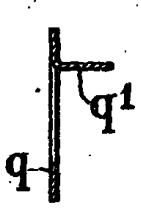
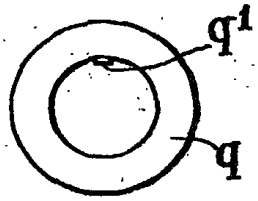


Fig.21



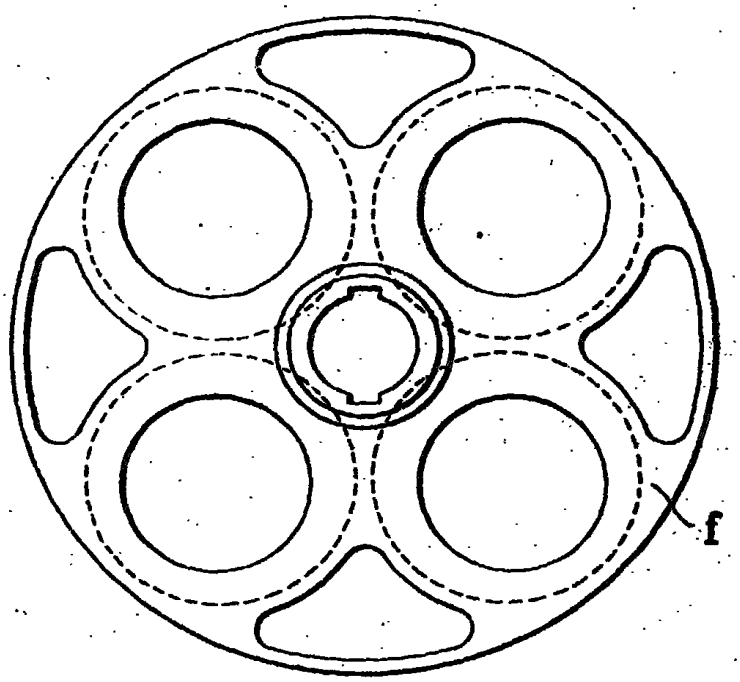


Fig. 6

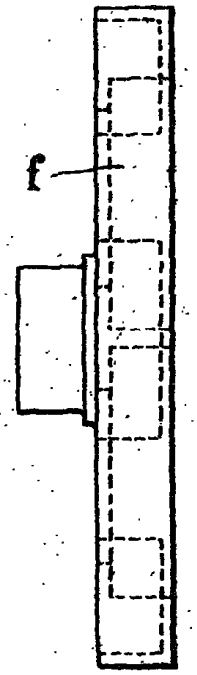


Fig. 7

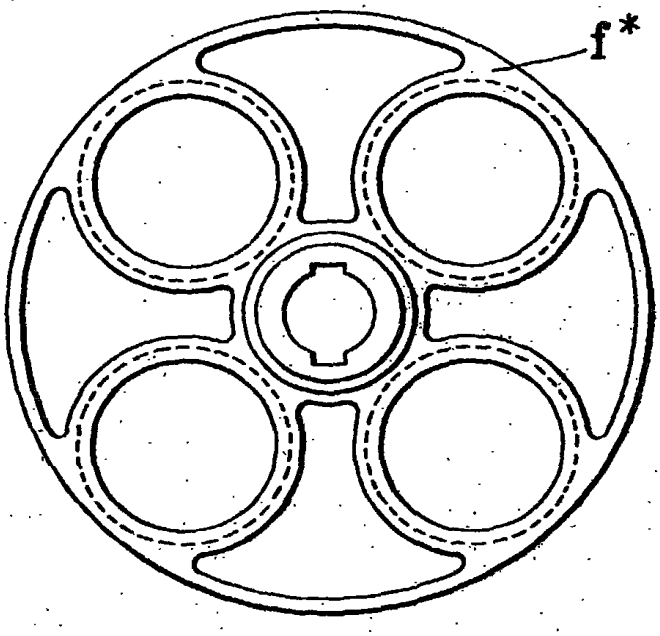


Fig. 8

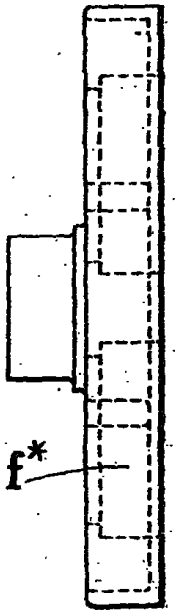


Fig. 9

Malby&Sons, Photo-Litho.