O. F. EDQVIST.

ROTARY EXPLOSIVE ENGINE.

APPLICATION FILED APR. 7, 1911.

1,026,911.

Patented May 21, 1912.

6 SHEETS—SHEET 1.

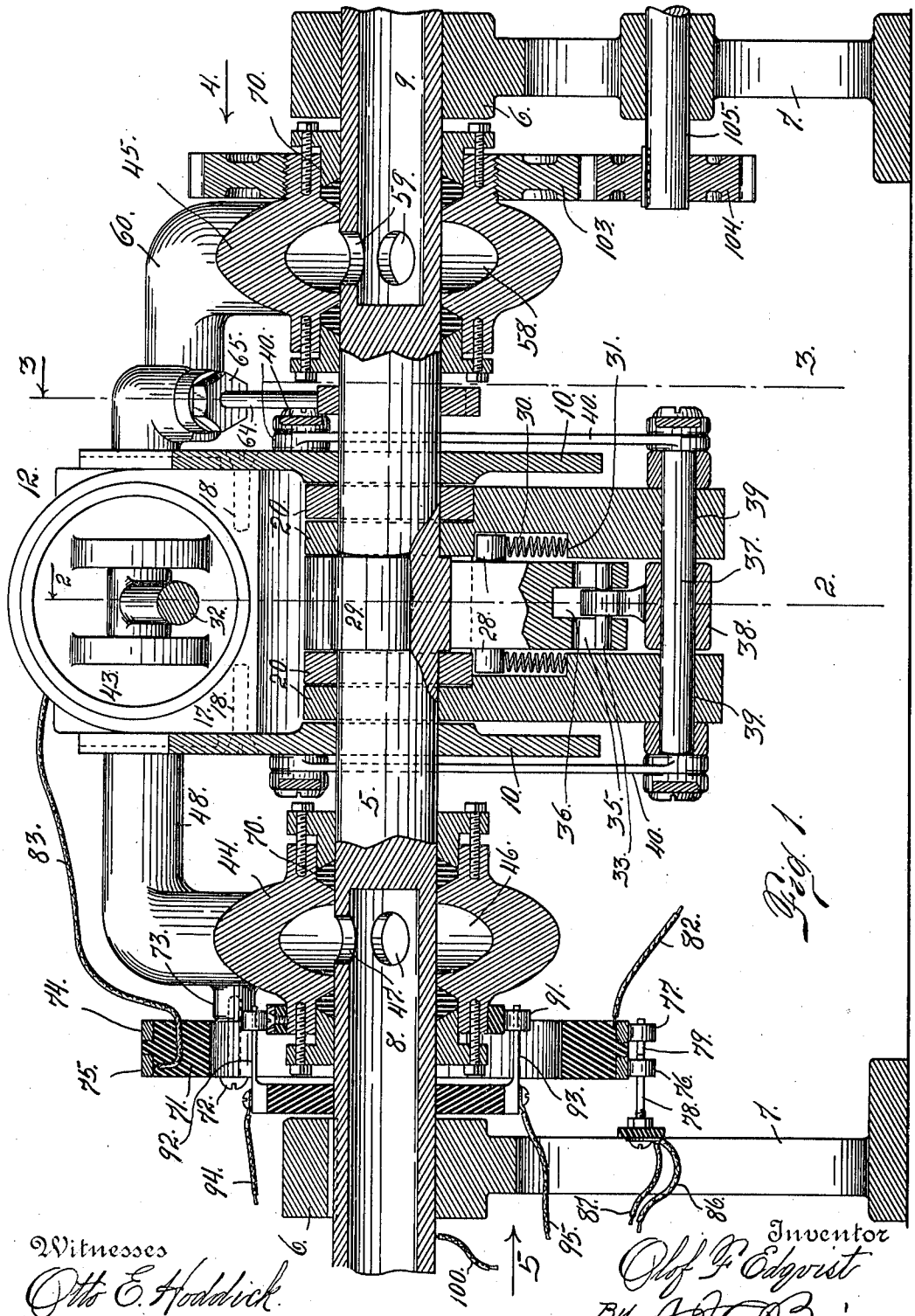

Fig. 1.

Witnesses

Otto E. Hoddick.

C. H. Roseneu.

Inventor

Olof F. Edqvist

By A. J. O'Brien

Attorney

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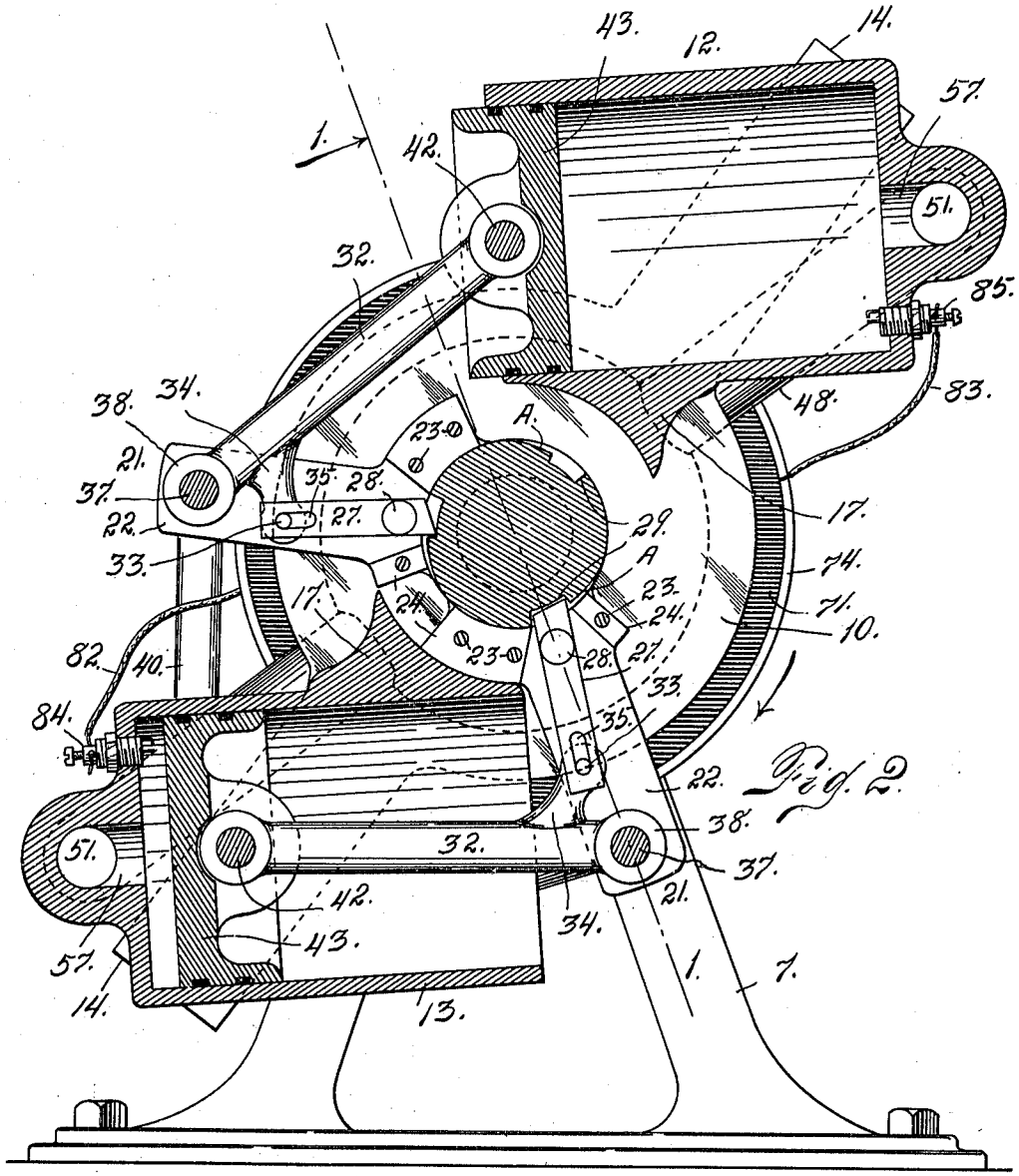

Fig. 2.

Witnesses,
Otto E. Hoddick.
C. H. Rossner.

Inventor
Olof F. Edqvist
By A. J. O'Brien
Attorney

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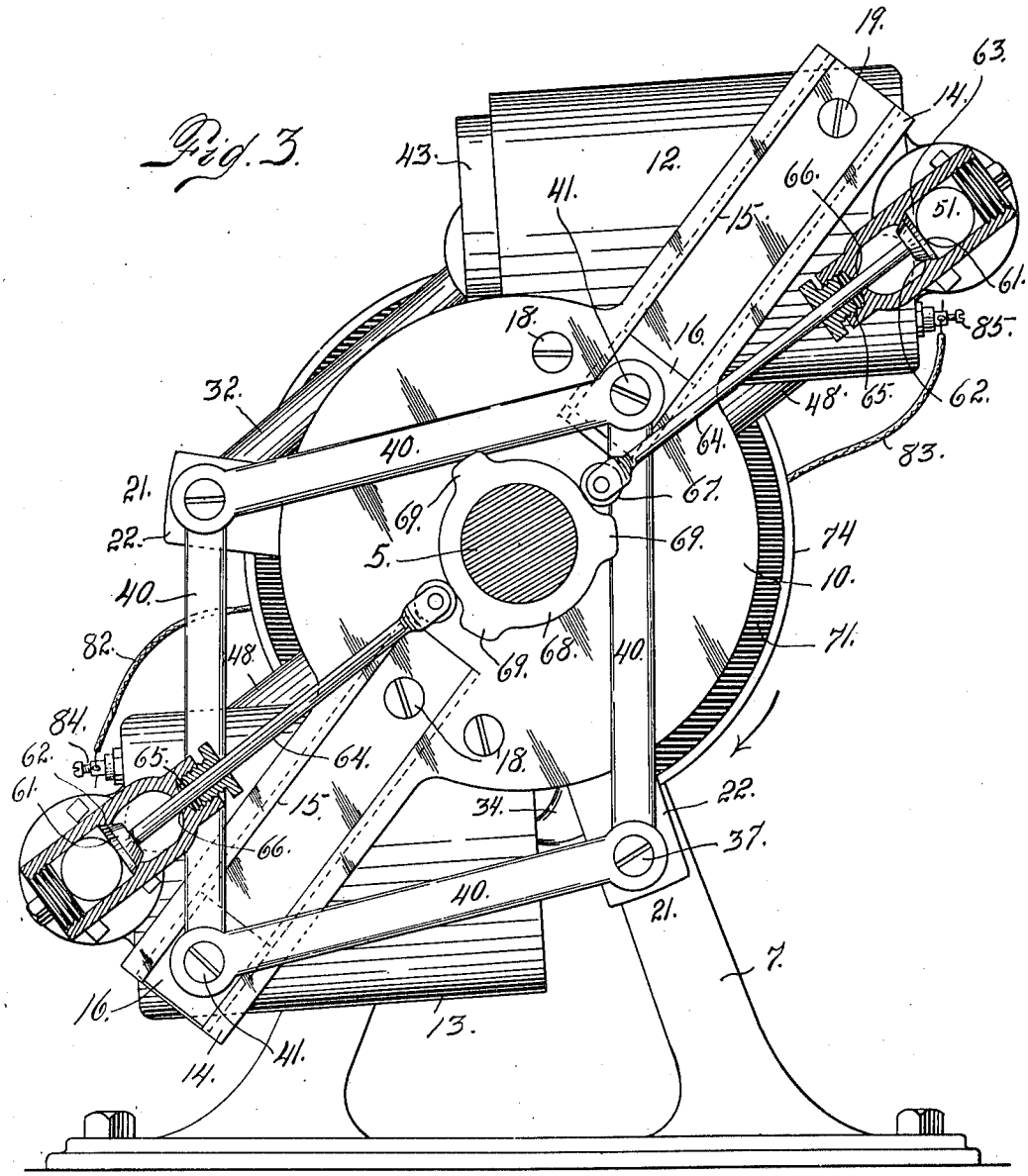
Fig. 3.



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C. H. Rossener.

Inventor

Olof F. Edqvist.

A. J. O'Brien

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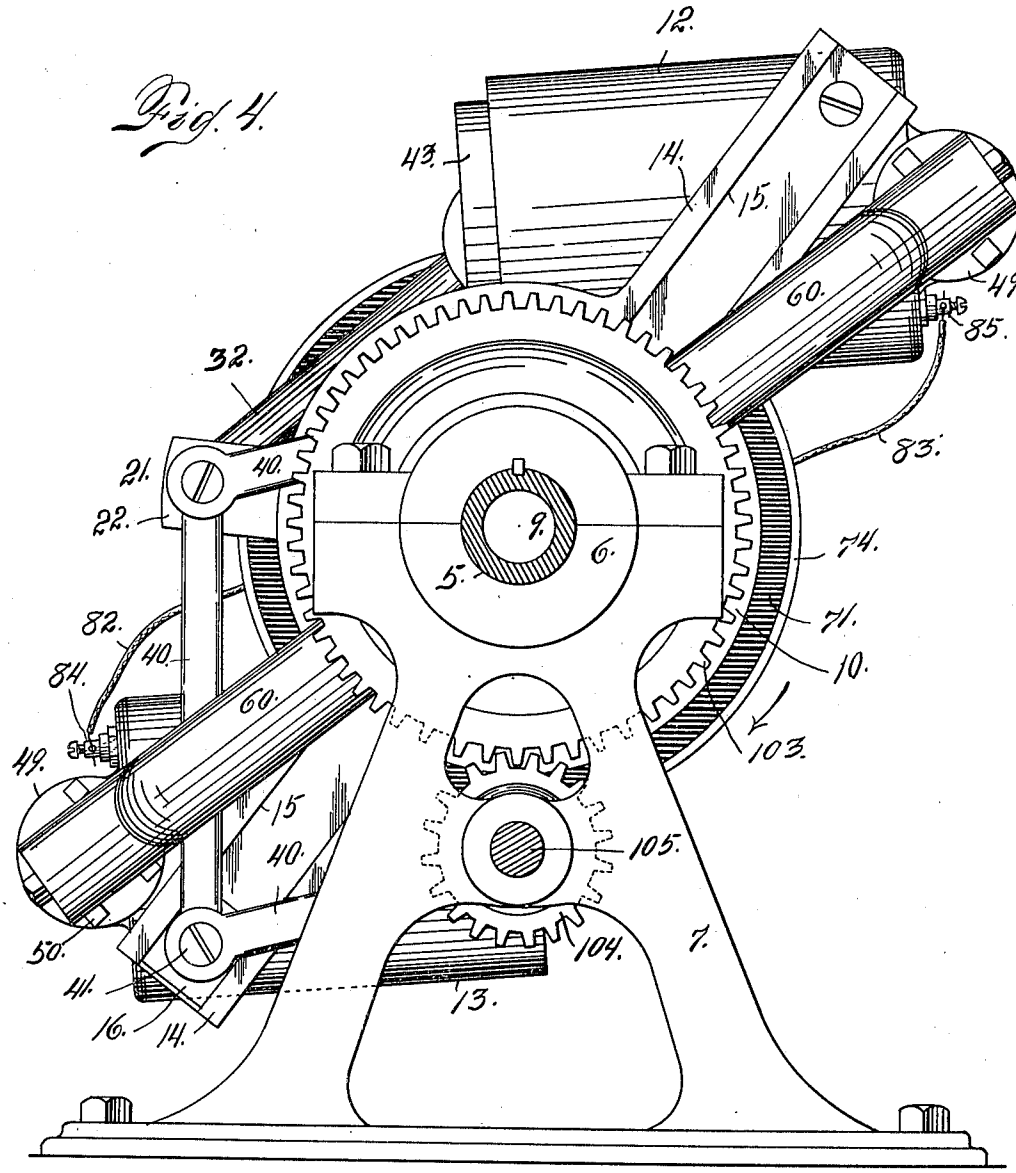
Fig. 4.



Witnesses

Otto E. Haddick.

C. H. Rossner.

Inventor

Olof F. Edqvist

By A. J. O'Brien

Attorney

O. F. EDQVIST.

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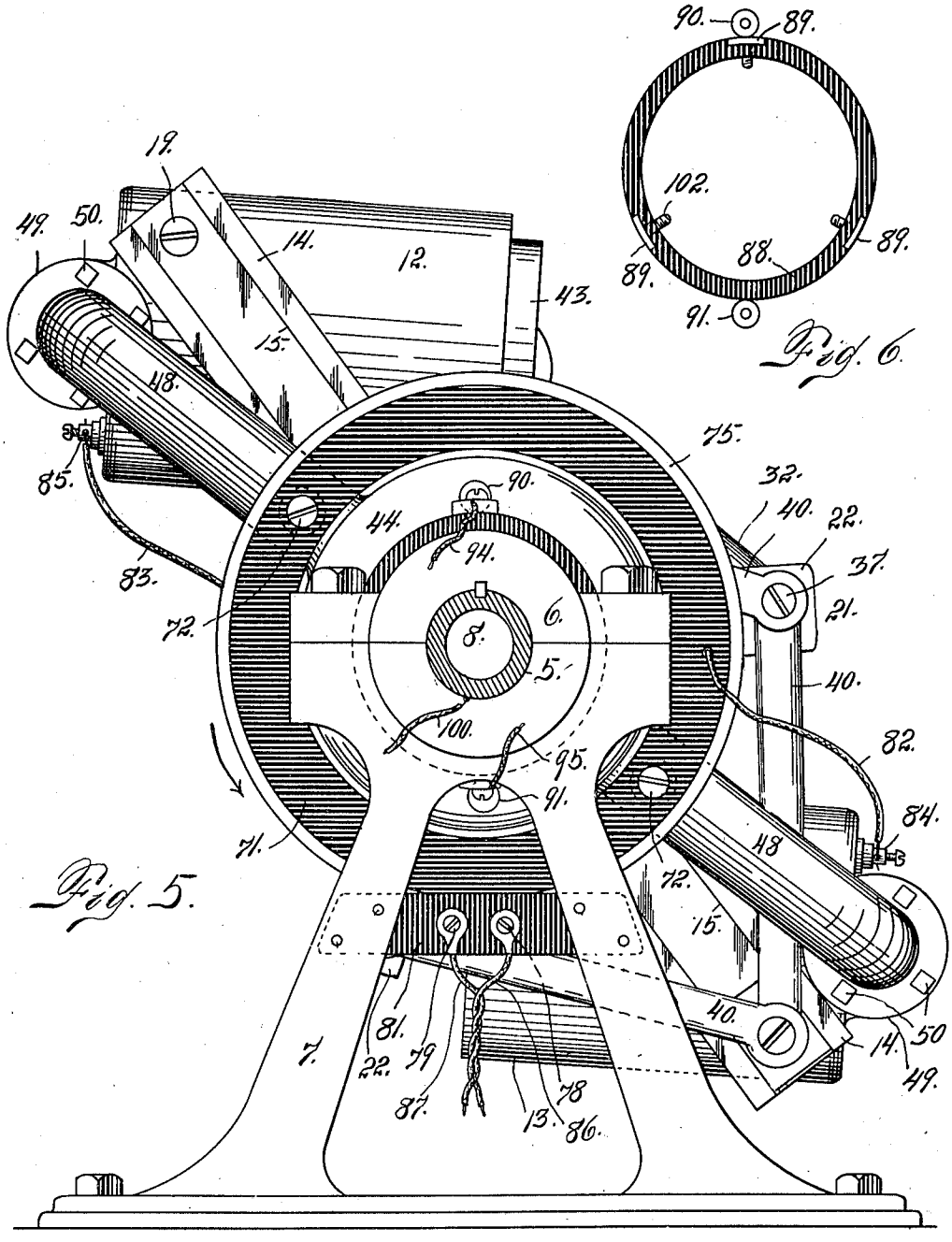

Fig. 5.

Fig. 6.

Witnesses

Otto E. Hoddick.

C. H. Roseneu.

Inventor

Olof F. Edqvist

By A. J. O'Brien

Attorney

O. F. EDQVIST.

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6 SHEETS—SHEET 6.

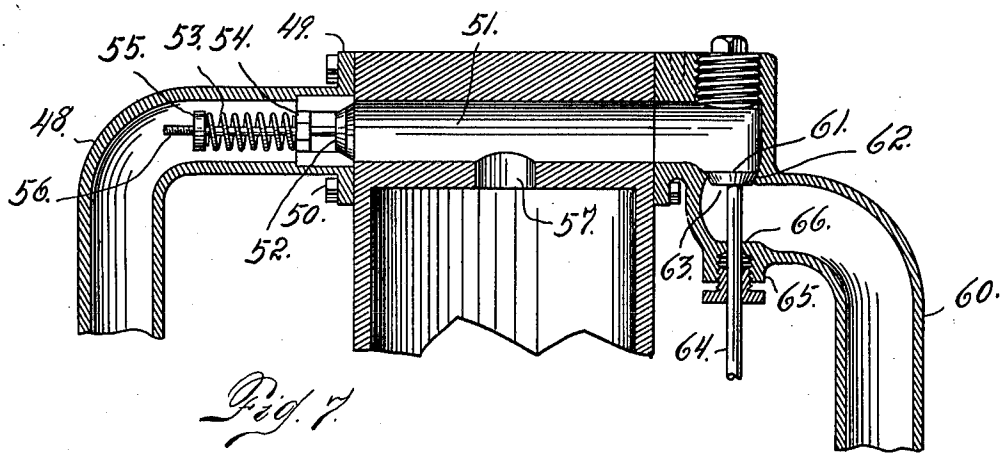

Fig. 7.

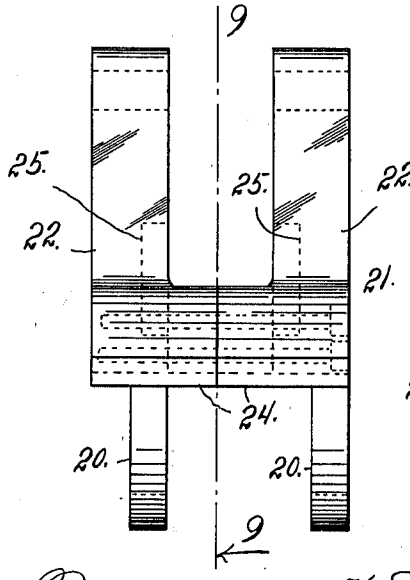

Fig. 8.

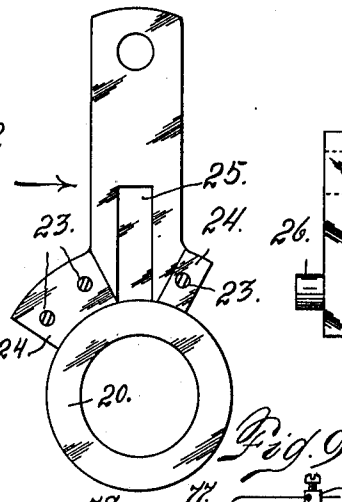

Fig. 9.

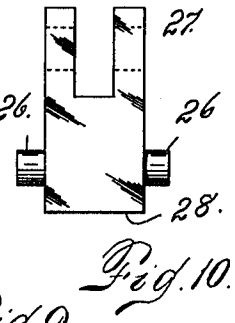

Fig. 10.

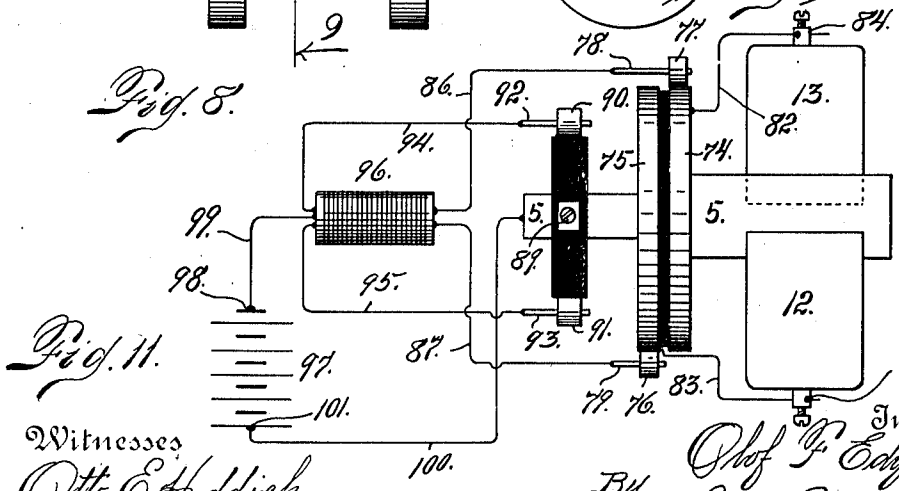

Fig. 11.

Witnesses:
Otto E. Hoddick.
C. H. Rossener.

Inventor
Olof F. Edqvist
By A. J. O'Brien
Attorney

UNITED STATES PATENT OFFICE.

OLOF F. EDQVIST, OF DENVER, COLORADO.

ROTARY EXPLOSIVE-ENGINE.

1,026,911. Specification of Letters Patent. Patented May 21, 1912.

Application filed April 7, 1911. Serial No. 619,521.

To all whom it may concern:

Be it known that I, OLOF F. EDQVIST, a subject of the King of Sweden, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Rotary Explosive-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rotary explosive engines. In my improved construction I employ a plurality of cylinders arranged to rotate around a stationary shaft between parallel planes cutting the shaft at right angles to its axis, the axes of the cylinders being parallel with said planes. These cylinders are mounted between parallel disks, the latter being journaled on the said shaft, the pistons of the cylinders being connected with members which move around the shaft independently of the cylinders, the said members carrying dogs arranged to intermittently lock the said members together with the pistons against movement while the cylinders are traveling. In the specific construction illustrated in the drawing two cylinders only are employed. It must be understood, however, that a greater number may be used if desired. Where two cylinders are employed their pistons are alternately locked against movement during the travel of the cylinders under the influence of the explosive action of the mixture ignited in each cylinder shortly after the cylinder begins to move away from its piston. This explosive force maintains the constant rotary action of the cylinders and the disks to which they are attached around the shaft.

While the pistons are locked during a part of the rotation of the cylinders, as soon as they are released their connection with the disks carrying the cylinders is such that they travel more rapidly than their respective cylinders, whereby the burned gases are scavenged or exhausted from the cylinders through ports formed in the extremities of the latter, toward which the pistons are traveling during their relatively rapid action.

The members carrying the dogs for locking the pistons against movement at regularly timed intervals, are connected by means of bars arranged in the form of a parallelogram, two of the bars being connected with each locking-dog-carrying member, the opposite extremities of each pair of bars being pivotally connected with blocks at diametrically opposite points, the said blocks being slidable in ways formed in arms projecting radially from the disks upon which the cylinders are mounted.

Provision is made whereby there are three explosions in each cylinder during a complete rotation, or six explosions in the two cylinders. This is accomplished through the aid of electrically operated sparking mechanism together with valves automatically actuated for the induction of the explosive mixture to the cylinders and its exhaust therefrom.

Having briefly outlined my improved construction and the principle upon which it operates, I will proceed to describe the same in detail, reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing: Figure 1 is a vertical section taken lengthwise of the axis of the stationary shaft and approximately on the line 1—1, Fig. 2. Fig. 2 is a section cutting the shaft at right angles to its axis in the plane of the axes of the cylinders. This section is taken on the line 2—2, Fig. 1, the parts being shown in elevation. Fig. 3 is a section taken on the line 3—3, Fig. 1, cutting the valve casings in which the valves for controlling the inlet of the explosive mixture and the exhaust of the burned gases are respectively located. Fig. 4 is an end elevation looking in the direction of arrow 4, Fig. 1, the main shaft together with the shaft from which the power developed by the machine is taken being shown in cross section. Fig. 5 is a view looking from the opposite end of the machine from that shown in Fig. 4, or a view looking in the direction of arrow 5, Fig. 1. Fig. 6 is a detail view of an insulating ring employed in connection with the sparking mechanism. Fig. 7 is a fragmentary sectional view taken through the outer extremity of one of the cylinders and illustrating the induction and exhaust passages together with the valves for regulating the inlet and exhaust. Fig. 8 is a detail view illustrating a locking-dog-holding member. This is a view looking in the direction of arrow 8, Fig. 9. Fig. 9 is a sectional view taken on the line 9—9, Fig. 8,

looking toward the left, the section being taken between the two parts of which the member 8 is composed. Fig. 10 is a detail view of the locking dog employed in connection with the construction disclosed in Figs. 8 and 9. Fig. 11 is a diagrammatic view illustrating the sparking mechanism adapted to be employed in connection with my improved engine.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate the stationary shaft, which is mounted in end bearings 6 supported upon upright castings 7. The opposite extremities of this shaft are formed hollow as shown at 8 and 9 for the entrance of the explosive mixture and the exhaust of the burned gases respectively. Journaled on this shaft are two separated disks 10 between which are secured the cylinders, which for convenience of reference will be designated 12 and 13 respectively. Though the cylinders are substantially identical, however, in the sequence of operation, their corresponding movements, as well as those of their pistons, are reversed, and for this reason it will be convenient to designate them by different reference characters.

Protruding from the body portions of the disks 10 and projecting radially therefrom in opposite directions, are arms 14 in which are formed ways 15, in which slide blocks 16. The portions of the cylinders which are adjacent the shaft are reinforced as shown at 17, and screws 18 are passed through the disks into the said reinforced portions, while other screws 19 are passed through the outer portions of the arms 14 and serve to further secure the cylinders rigidly to and between the said disks and the arms 14 of the latter.

Interposed between the two disks 10 and having collars 20 surrounding the shaft and movable freely thereon, are two members 21 each composed of two parts 22 connected by bolts 23 entering segmental members 24 which are in contact with each other, as illustrated in Fig. 8. The two parts 22 are separated and in their inner surfaces are formed grooves 25 which are engaged by trunnions 26 formed on a dog 27 whose inner extremity 28 is adapted to enter recesses 29 formed in the stationary shaft and arranged at equal intervals around the said shaft. Also located within the grooves 24 and bearing against the trunnions of said dogs, are spiral springs 30. One extremity of each spring bears against the outer end of the groove as shown at 31, while its inner extremity bears against the trunnions. By virtue of the action of these springs the inner extremities of the dogs are forced into the said recesses as soon as the dog-carrying members 21 are in such position as to permit this action. Each dog is further connected with an adjacent piston stem 32 by means of a pin 33 passing through a lug 34 formed on the piston stem, the outer portions of the pins entering slots 35 formed in the opposite sides of the said dog, the latter being centrally slotted as shown at 36 to receive the said piston stem lug. By virtue of this construction and arrangement each dog is adapted not only to automatically interlock with the shaft, but also to be automatically released at predetermined intervals, that is to say, as soon as the piston has reached its outward position in its cylinder by virtue of the movement of the cylinder, while the piston is locked against travel.

Each dog-carrying member 21 is connected with the outer extremity of a piston stem 32 by means of spindles 37 which pass through relatively long collars 38 formed on the outer extremities of the piston stems, and also through registering openings 39 formed in the outer extremities of the parts 22 of the locking-dog-carrying member 21. These spindles further serve to connect the adjacent extremities of four pairs of arms 40, two pairs being located outside of each disk 10 and on opposite sides of the path in which the cylinders rotate, the two pairs of arms on each side being arranged to form a parallelogram, their extremities opposite those through which the spindles 37 pass being pivotally connected with the blocks 16 as shown at 41. The extremity of each piston stem 32 remote from the locking-dog-carrying member 21 is pivotally connected as shown at 42 with a piston 43 arranged to reciprocate within a cylinder 12 or 13 as the case may be.

Journaled on the shaft on opposite sides of the path of the cylinders, are hollow collars 44 and 45. The chamber 46 of the collar 44 is in communication through openings 47 with the hollow extremity 8 of the shaft 5, into which the explosive mixture is delivered, and from which it passes first into the chamber 46 of the said collar and afterward through pipes 48 to the respective cylinders 12 and 13, the said pipes or conduits being elbow-shaped and cast integral with the hollow collar, their extremities remote from the collar being flanged as shown at 49 and secured to the outer extremity of the cylinder by bolts 50 passing through said flanges into the cylinder head on opposite sides of a passage 51 in communication with the induction pipe 48. The entrance of the explosive mixture to each cylinder is controlled by an inwardly-opening check valve 52 normally held in the closed position by a spring 53 interposed between a skeleton or spider shaped stop 54 and a tension screw 55 threaded on the end of the valve stem 56, the said stem passing through the skeleton stop 54 and being movable freely therein. During the inward movement of the piston or its movement

away from the outer head of the cylinder, the suction produced in the passage 51, which is in communication with the cylinder chamber through an opening 57, results in opening the valve 52 to allow the explosive mixture to enter. The hollow collar 45 on the opposite side of the path of the rotating cylinder, has a chamber 58 in communication through openings 59 with the hollow portion 9 of the shaft 5 for exhaust purposes. This hollow collar 45 is formed integral with exhaust conduits 60 whose extremities remote from the collar are in communication with the outer head of the respective cylinders, the exhaust from the cylinders being regulated by valve 61 engaging seats 62 around exhaust ports 63 which connect the passage 51 in the cylinder heads with the said exhaust conduits. The stem 64 of each valve 61 passes through a stuffing box 65 adjacent an opening 66 at the outer extremity of the exhaust conduit, whereby a fluid-tight joint is formed. This stem 64 projects inwardly, its inner extremity being equipped with a roller 67 which engages a cam ring 68 fast on the stationary shaft, the said ring having three cams or projections 69 equi-distantly arranged thereon, and so located that as the cylinders rotate the inner extremities of the valve stem 64 engage the cams 69 at proper intervals to open the exhaust valve at the proper time. As three explosions occur in each cylinder during each complete rotation, it follows that there must be three exhausts of burned gases through each cylinder, and consequently each valve 63 is opened and closed three times during each rotation of its corresponding cylinder. The pressure within each cylinder when the explosion takes place and also during the admission of the explosive mixture, is such as to maintain the exhaust valve 61 normally closed.

Each hollow collar 44 and 45 is equipped on opposite sides with stuffing boxes 70, whereby fluid-tight joints are formed between the collars and the hollow extremities of the shaft, thus preventing the escape of either the explosive mixture or the burned gases at these locations.

The sparking mechanism which may be employed in connection with my improved engine, will now be briefly described, though nothing is claimed in this application upon this particular feature.

A relatively large insulating ring 71 surrounds the hollow extremity 8 of the shaft and is connected with the induction pipes 48 by means of screws 72, which after passing through said rings enter bosses or projections 73 formed on the pipes 48 for the purpose. By virtue of this connection the said rings 71 are compelled to rotate around the shaft 5 with the cylinders, the conduits 48 and the collar 44. Upon the periphery of this insulating ring are mounted two contact rings 74 and 75, which are respectively engaged by contacts 76 and 77 mounted on the stationary supports 7 at one end of the machine, the said contacts 76 and 77 being mounted on pins 78 and 79 connected with the supports 7, the said pins being insulated from the supports 7 as shown at 81. From these rings 74 and 75 conductors 82 and 83 lead respectively to the two cylinders 12 and 13 of the engine, where they are connected with sparking plugs 84 and 85. The pins 78 and 79 carrying the contacts 76 and 77 respectively as heretofore explained, are connected with conductors 86 and 87 respectively. A second insulating ring 88 carries three contacts 89 which are brought into engagement at regular intervals with rollers 90 and 91 carried by pins 92 and 93, and respectively connected with conductors 94 and 95.

The spark plug circuit is diagrammatically disclosed in Fig. 8 of the drawing. The parts of the spark plug mechanism heretofore described are disclosed in Fig. 1 of the drawing, and partially in the other views. The complete circuit, however, is only illustrated in Fig. 8. In this figure the numeral 96 designates an induction coil and 97 a battery or suitable electrical source. From the pole 98 of this battery a wire 99 leads to the coil 96, and from this coil wires 86 and 87 lead to the pins 78 and 79 carrying the rollers 76 and 77, while from the rings 74 and 75 the conductors 82 and 83 lead respectively to the spark plugs 84 and 85, the said spark plugs being connected with the cylinders 13 and 12 respectively. From one extremity of the shaft 5 a wire 100 leads to the opposite pole 101 of the battery; while the wires 94 and 95 connected with the pins 92 and 93, lead to the spark plug and carry the induced current. Hence every time a contact 89 which is connected with the framework of the machine by means of a screw 102, is brought into engagement with a contact roller 90 or 91 as the case may be, the circuit is closed through one or the other of the spark plugs, and a spark produced within the cylinder, whereby the mixture is exploded, the mechanism being so constructed that the explosions are properly timed.

From the foregoing description the use and operation of my improved engine will be readily understood. Referring now more particularly to Figs. 2 and 3, I will assume that the cylinders 12 and 13 are in the positions therein illustrated, the piston 43 of the cylinder 12 being at the open or outer extremity of the cylinder, while the corresponding piston of the cylinder 13 is at the inner extremity of the latter. Under these circumstances the piston stem 32 of the cylinder 13 together with its piston, is locked

against rotary travel with its cylinder, by virtue of the fact that the locking dog 27 connected with the said stem has its inner extremity in locking engagement with a recess 29 of the shaft 5. Hence assuming that the cylinders together with their disks 10 are in rotary motion around the shaft, as is the case when the engine is in operation, the two cylinders 12 and 13 will continue to travel, while the piston 43 of the cylinder 13 being locked against rotary travel, will soon be in the outer extremity of its cylinder, since the latter is moving away from the piston. During the first part of the movement of the cylinder 13 away from its piston, the explosive mixture is drawn into the said cylinder between its head and the piston, and shortly afterward by virtue of the construction and arrangement of the sparking mechanism, the explosive mixture so drawn into the cylinder is exploded, the explosive force acting to propel the disks 10 and their cylinders in a circular path around the shaft 5. During this operation, the cylinder 13 traveling away from its piston so to speak, as aforesaid, the blocks 16 are caused to travel in the ways of the arms 14, the block adjacent the cylinder 13 traveling inwardly, and the block adjacent the cylinder 12 traveling outwardly by virtue of the connection and arrangement of the two pairs of arms 40 arranged on each side of the path of the cylinders, and connected with the locking-dog-carrying members 21 and the blocks 16. During the inward travel of the block 16 adjacent the cylinder 13, the rotary travel of the pivot screw 41 of the block 16 is comparatively little, while the corresponding travel of the spindle 37 connected with the stem 32 of the piston 43 of the cylinder 12 is much greater, and since the rotary travel of the pivot screw 41 corresponds with the corresponding travel of the disks 10 and the two cylinders, the piston 43 of the cylinder 12 will travel much faster than its cylinder, and consequently though both are engaged in rotary travel, the piston 43 of the last named cylinder will gradually approach the inner extremity of the said cylinder and drive out the burned gases through the exhaust port 63 and the connecting elements arranged for exhaust purposes as heretofore explained, the opening of the valve 61 being properly timed for this purpose.

Attention is called to the fact that when the cylinder 12 is in the position illustrated in the drawings (see particularly Figs. 2 and 3), the locking dog 27 connected with the piston stem 29 of the piston 43 of the cylinder 12, will be thrown to the releasing position (see Fig. 2), and will therefore allow the piston stem 32 and the piston 43 of the cylinder 12 to travel freely around the shaft, until the said dog has traveled 120 degrees, or reached the next notch 29 of the shaft 5, in which event the dog will be forced into the said recess and will engage the same in locking relation, thus locking the piston 43 of the cylinder 12 against rotary travel around the shaft, whereby the cylinder 12 will travel away from its piston, so to speak. During the first part of this travel the explosive mixture will be drawn into the cylinder 12, while shortly afterward the mixture so drawn in will be exploded, the force of the explosion acting to maintain the rotary travel of the cylinders, their disks 10 and connected mechanism, around the shaft. While this operation is occurring in the cylinder 12, the locking dog 27 connected with the stem 32 of the piston of the cylinder 13, will have been released, allowing its piston to travel inwardly from the outer extremity of the cylinder by virtue of the face that the piston will travel faster than the cylinder as heretofore explained, whereby the burned gases will be expelled, preparatory to receiving the next charge of explosive mixture and the ignition of the latter in regular order as heretofore explained. In this way the cylinders and their disks are caused to rotate around the shaft 5, whereby power is advantageously developed. This power is taken from the engine through the medium of a gear 103 made fast to the hollow collar 45 and rotating therewith, the said gear meshing with a gear 104 fast on a shaft 105 which may be suitably connected to do work of any character.

Attention is called to the fact that the shaft 5 is slightly cut away adjacent the recesses 29, as shown at A, on the approaching side, in order to insure the engagement of the dogs with the recesses when the machine is in operation. If it were not for this construction the dogs might jump over the recesses, that is to say, if the shaft on the approaching side were as high above the bottom of the notches as on the opposite side.

Having thus described my invention, what I claim is:

1. In a rotary explosive engine, the combination with a stationary shaft, of a cylinder mounted to rotate continuously around the shaft, a piston arranged to reciprocate in said cylinder, means for intermittently locking the said piston against travel, means for releasing the piston, and means for varying the speed of the piston with respect to the cylinder.

2. In a rotary explosive engine, the combination with a stationary shaft, of a cylinder mounted to rotate continuously around the shaft, a piston mounted to reciprocate in said cylinder, means for automatically and intermittently locking said piston against travel, means for automatically re-

leasing the piston, and means for varying the speed of the piston with respect to the cylinder.

3. In a rotary explosive engine, the combination with a stationary shaft, of a plurality of cylinders mounted to rotate continuously around the shaft, pistons mounted to reciprocate in the respective cylinders, means for intermittently locking the pistons against travel, means for automatically releasing the pistons, and means for varying the speed of the pistons with respect to the cylinders, substantially as described.

4. In a rotary explosive engine, the combination with a stationary shaft, of a plurality of cylinders mounted to rotate continuously around the shaft, pistons arranged to reciprocate in said cylinders, means for automatically locking the pistons against travel in alternate order, and means for varying the speed of the rotary travel of the pistons with respect to the cylinders, substantially as described.

5. In a rotary explosive engine, the combination with a stationary shaft, of a plurality of cylinders mounted to rotate continuously around the shaft, the cylinders being so arranged that their produced axes do not intersect the axis of rotation, pistons arranged to reciprocate in said cylinders, means for automatically and intermittently locking the pistons against travel, means for releasing the pistons, and means for varying the speed of the latter with respect to their cylinders, substantially as described.

6. In a rotary explosive engine, the combination with a stationary shaft, of a cylinder mounted to rotate continuously around the shaft, the cylinder being so arranged that its produced axis will not intersect the axis of rotation, a piston mounted to reciprocate in said cylinder in the direction of its axis, means for automatically and intermittently locking the piston against travel, means for releasing the piston, and means for varying the speed of the piston with respect to its cylinder.

7. In a rotary explosive engine, the combination with a stationary shaft, of a plurality of cylinders mounted to rotate continuously around the shaft, the cylinders being so arranged that their produced axes do not intersect the axis of rotation, pistons arranged to reciprocate in said cylinders in the direction of their axes, means for automatically and intermittently locking the pistons against travel in alternate order, means for automatically and intermittently releasing the pistons in reverse order, and means for varying the speed of the pistons with reference to their respective cylinders, substantially as described.

8. In a rotary explosive engine, the combination with a stationary shaft, of a plurality of cylinders mounted to rotate continuously around the shaft, the cylinders being so arranged that their axes do not intersect the axis of rotation, pistons arranged to reciprocate in said cylinders in the direction of their axes, means for automatically and intermittently locking the pistons against travel in their respective cylinders in reverse order, means for automatically and intermittently releasing the pistons in reverse order, means for varying the speed of the pistons with respect to their cylinders, valves for admitting explosive mixture to the cylinders, and valves for permitting the escape of the products of combustion, substantially as described.

9. In a rotary explosive engine, the combination with a stationary shaft, of a plurality of cylinders, disks between which the said cylinders are secured, the disks being journaled on the shaft, the cylinders being so arranged that their axes do not intersect the axis of rotation, pistons arranged to reciprocate in said cylinders in the direction of the respective axes of the latter, means for automatically and intermittently locking the pistons against travel in their respective cylinders, means for automatically releasing the said pistons, and means for varying the speed of travel of the pistons with respect to their cylinders, substantially as described.

10. The combination with a stationary shaft, of disks journaled on the shaft and suitably separated, cylinders interposed between the disks and secured thereto, the cylinders being so arranged that their axes do not intersect the axis of rotation, pistons arranged to reciprocate in said cylinders in the direction of their axes, means for automatically and intermittently locking the pistons against travel in their respective cylinders, means for releasing the pistons, means for varying the speed of the pistons with respect to their cylinders, valves for admitting explosive mixture to the cylinders, and valves for permitting the escape of the products of combustion, substantially as described.

11. In a rotary explosive engine, the combination with a stationary shaft, of a cylinder mounted to rotate around said shaft, the cylinder being so arranged that its axis does not intersect the axis of rotation, a piston arranged to reciprocate in said cylinder in the direction of its axis, means for locking said piston to the shaft at equi-distant points in its rotary travel, means for retaining the piston at predetermined intervals, and means for varying the rotating speed of the piston with respect to the cylinder.

12. The combination with a stationary shaft, of a cylinder mounted to rotate around said shaft, the cylinder being so arranged that its axis does not intersect the axis of

rotation, a piston arranged to reciprocate in said cylinder in the direction of its axis, means for locking said piston to the shafts at equi-distant points in its rotary travel, means for releasing the piston at predetermined intervals, means for varying the rotative speed of the piston with respect to the cylinder, and means for causing the piston when released to travel rotatively faster than the cylinder, whereby the reciprocating action is produced.

13. The combination with a stationary shaft, of cylinders arranged to rotate continuously around the shaft and so that their axes do not intersect the axis of rotation, pistons located in said cylinders, means for locking said pistons to the shaft at equi-distant points in their rotative travel, means for releasing one piston simultaneously with the locking of another piston, and means for causing each piston when released to travel faster than its cylinder, to produce the necessary reciprocating movement.

14. In a rotary explosive engine, the combination with a stationary shaft, of a framework mounted to rotate thereon, cylinders carried by said framework and arranged so that their axes shall not intersect the axis of rotation, pistons in said cylinders, members connected to rotate around said shaft independently of the cylinders and carrying spring-actuated locking dogs adapted to engage recesses formed in the shaft, whereby the said members are intermittently locked to the shaft at predetermined intervals, stems connecting the pistons with said members, the stem extremities being pivoted to the connected parts, the locking dogs being connected with the piston stems at points removed from the points where the piston stems are connected with the dog-carrying-members, whereby the dogs are released from the recesses of the shaft at predetermined intervals, blocks radially slidable on the frame at diametrically opposite points, bars having their extremities pivotally connected with said blocks and the said locking-dog-carrying members at the points where the piston stems are connected, to form a figure of polygonal shape, and means for successively producing explosions in the cylinders, whereby the latter are continuously rotated, and their pistons intermittently rotated, but at greater speed, substantially as described.

15. In a rotary explosive engine, the combination with a stationary shaft, of a framework mounted to rotate thereon, two cylinders carried by said framework in balanced relation and arranged so that their axes shall not intersect the axis of rotation, pistons in said cylinders, two members connected to rotate around said shaft independently of the cylinders, and carrying spring-actuated locking dogs adapted to engage recesses formed in the shaft, whereby the said members are intermittently locked to the shaft at predetermined intervals, stems connecting the pistons with said members, the stem extremities being pivoted to the connected parts, the locking dogs being connected with the piston stems at points removed from the points where the piston stems are connected with the dog-carrying members, whereby the dogs are released from the recesses of the shaft at predetermined intervals, two blocks radially slidable on the frame and on opposite sides of the shaft, four arms having their extremities pivotally connected with the said blocks and with the said locking-dog-carrying members at the points where the piston stems are connected, to form a parallelogram, and means for successively producing explosions in the cylinders, whereby the latter are continuously rotated and their pistons intermittently rotated, substantially as described.

16. In a rotary explosive engine, the combination with a shaft, of a framework mounted to rotate thereon, cylinders carried by the said framework in balanced relation and arranged so that their axes shall not intersect the axis of rotation, pistons in the said cylinders, members connected to rotate around the said shaft independently of the cylinders, and carrying spring-actuated locking dogs adapted to engage recesses formed in the shaft, whereby the said members are intermittently locked to the shaft at predetermined intervals, stems connecting the pistons with said members, the stem extremities being pivoted to the connected parts, blocks radially slidable on the frame, bars having their extremities pivotally connected with said blocks and with the said locking-dog-carrying members at the points where the piston stems are connected, to form a figure of polygonal shape, means for successively producing explosions in the cylinders while the latter are continuously and their pistons intermittently rotated, normally closed spring-actuated valves for admitting explosive mixture to the cylinders by suction, exhaust valves having radially arranged stems, and a collar fast on the shaft, and having cams which the inner extremities of the exhaust valve stem engage to open said palves at properly timed intervals, substantially as desired.

In testimony whereof I affix my signature in presence of two witnesses.

OLOF F. EDQVIST.

Witnesses:
F. E. BOWEN,
WILMA H. COON.