E. G. JOHANSON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JUNE 11, 1917.

1,306,699.

Patented June 17, 1919.

5 SHEETS—SHEET 1.

Fig. 1.

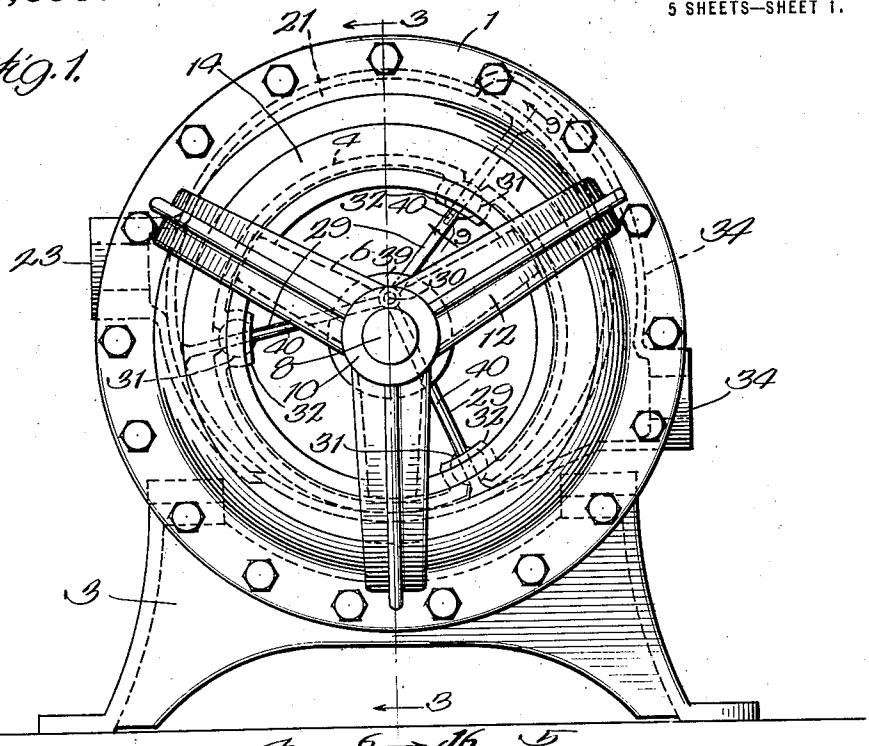
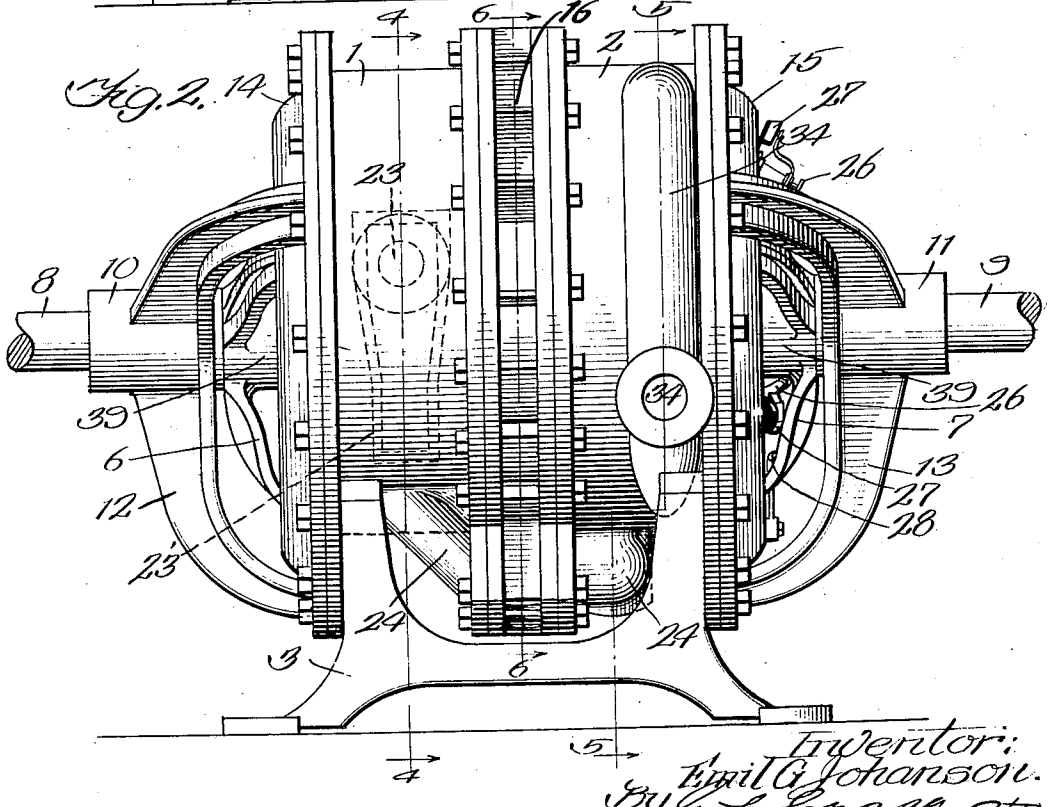


Fig. 2.



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5 SHEETS—SHEET 2.

Fig. 3.

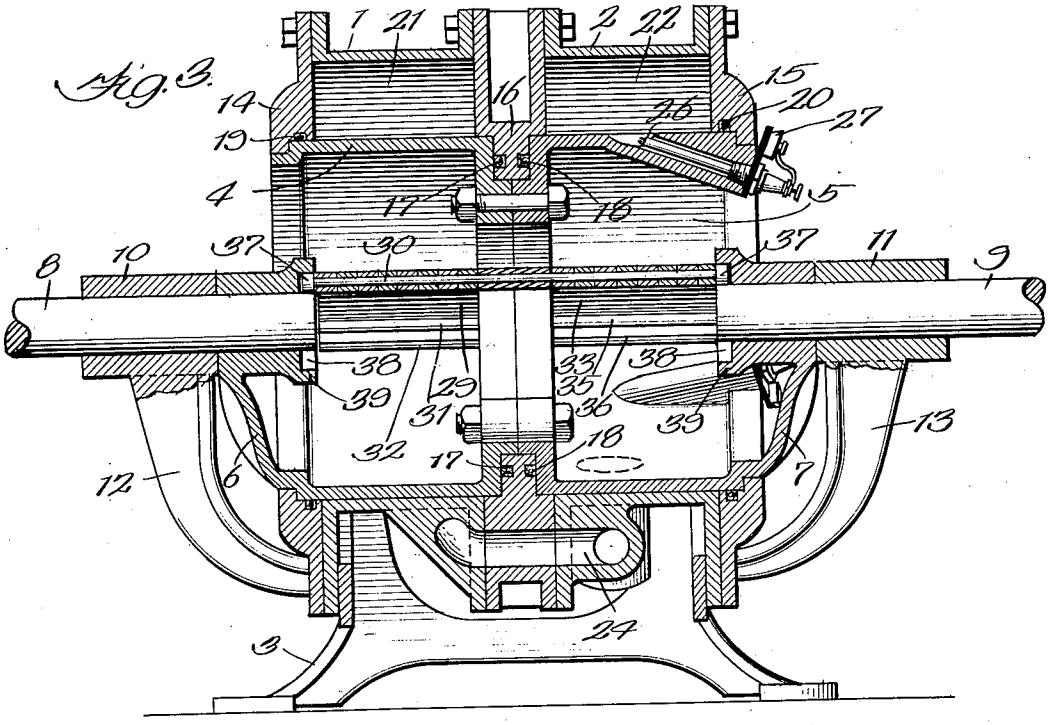
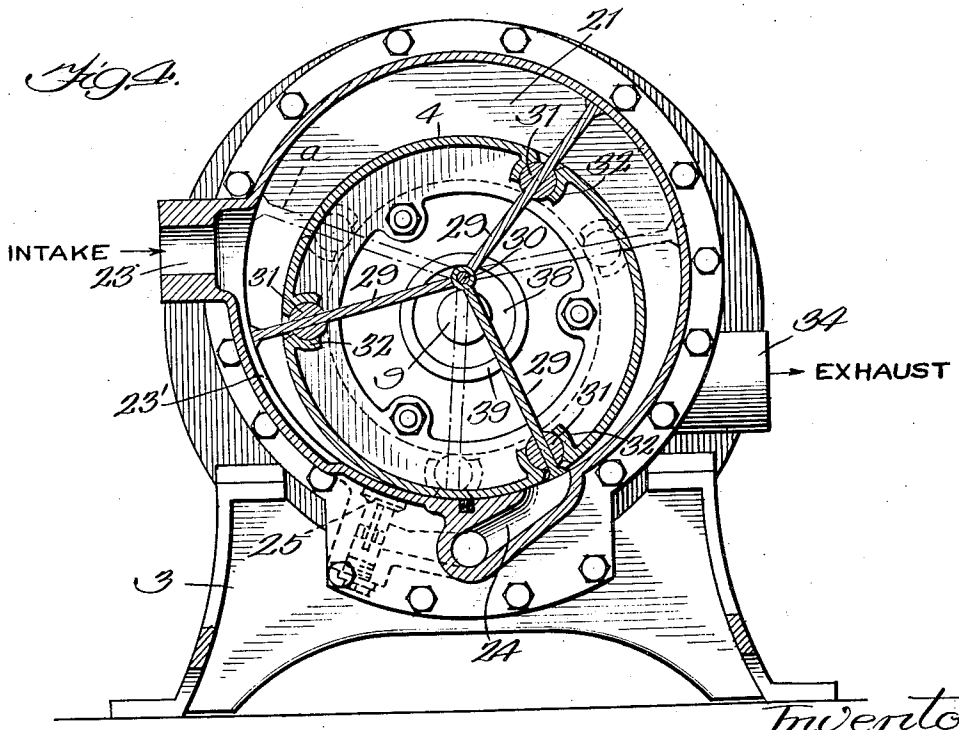


Fig. 4.



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5 SHEETS—SHEET 3.

Fig. 5.

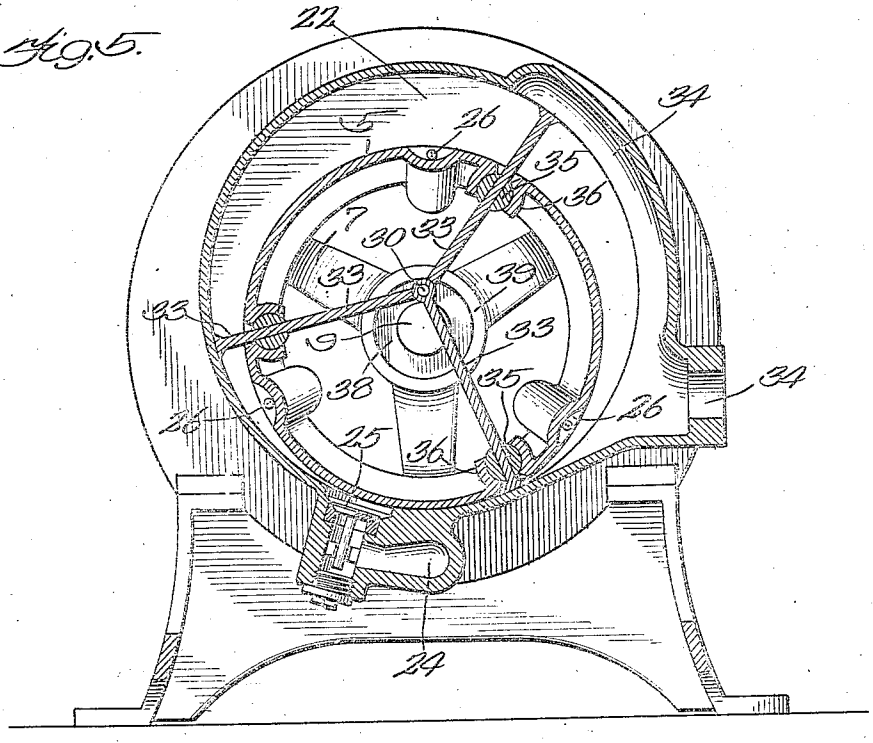
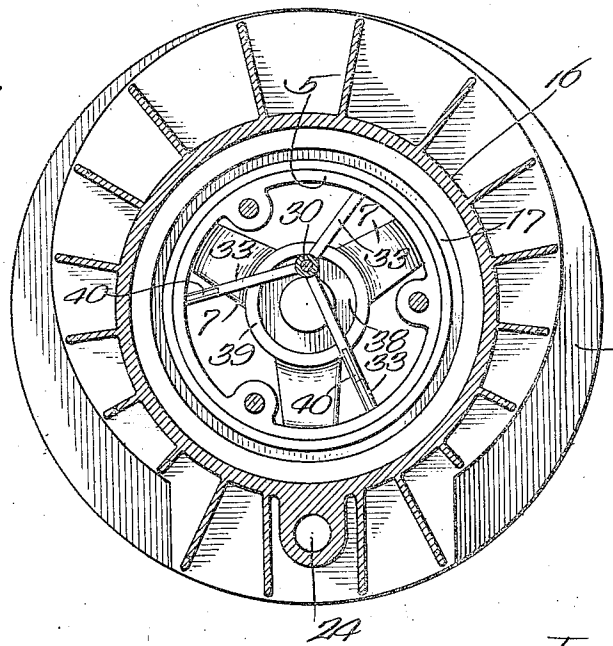


Fig. 6.



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5 SHEETS—SHEET 4.

Fig. 7.

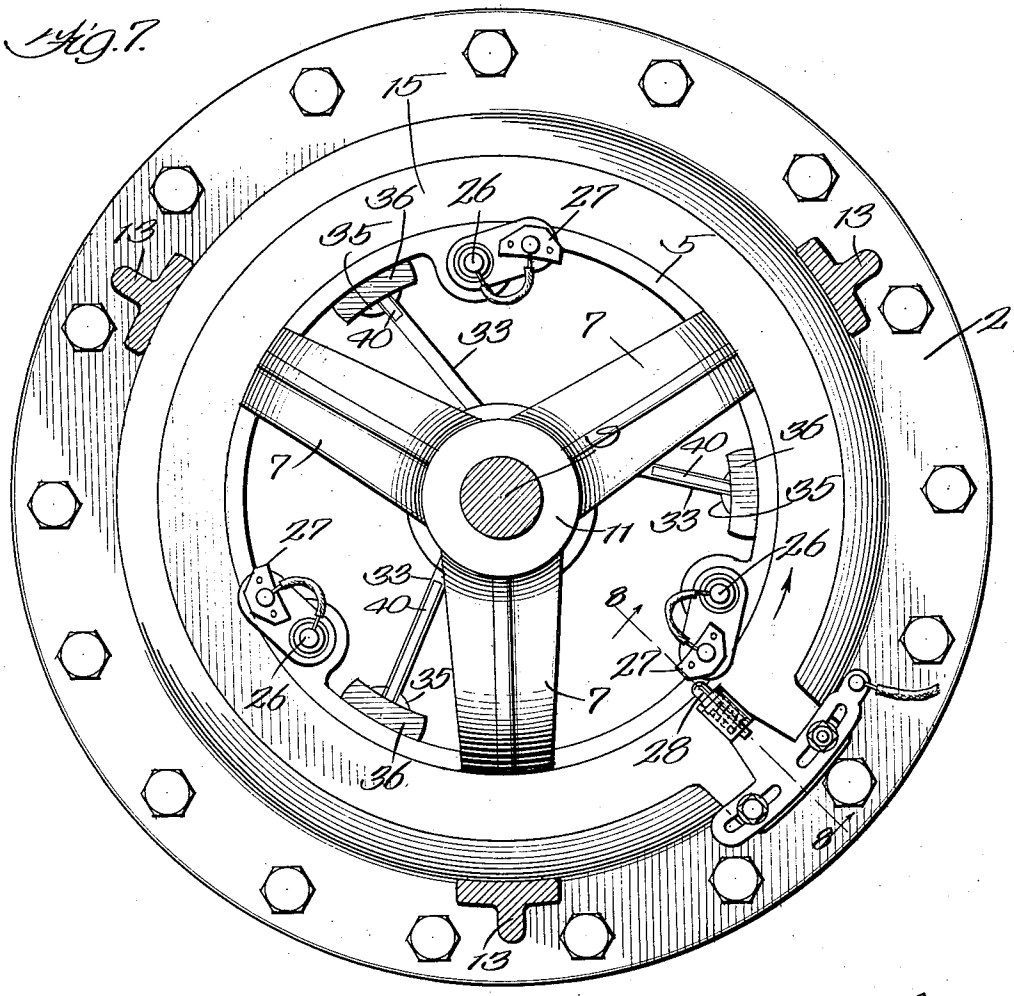
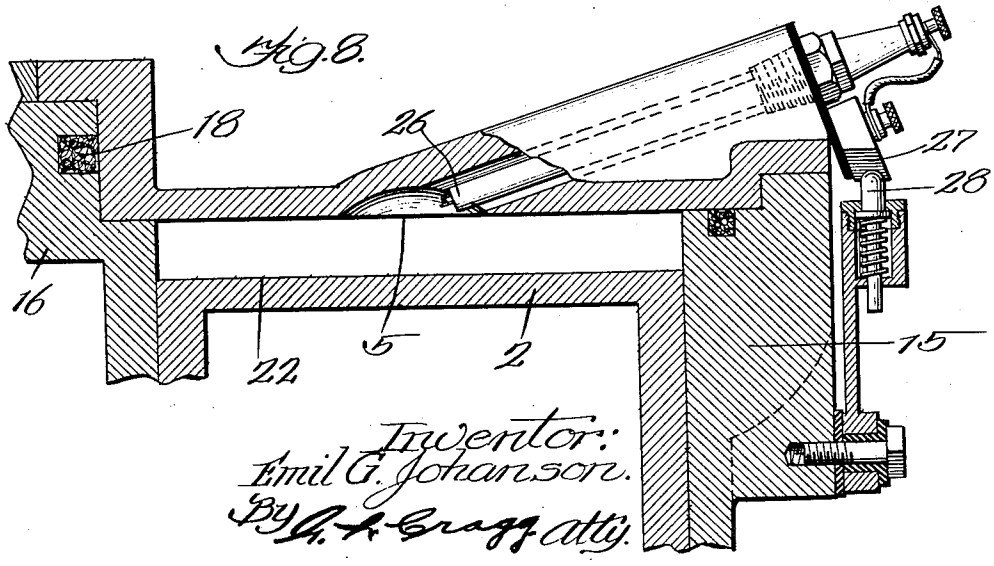


Fig. 8.



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5 SHEETS—SHEET 5.

Fig. 9.

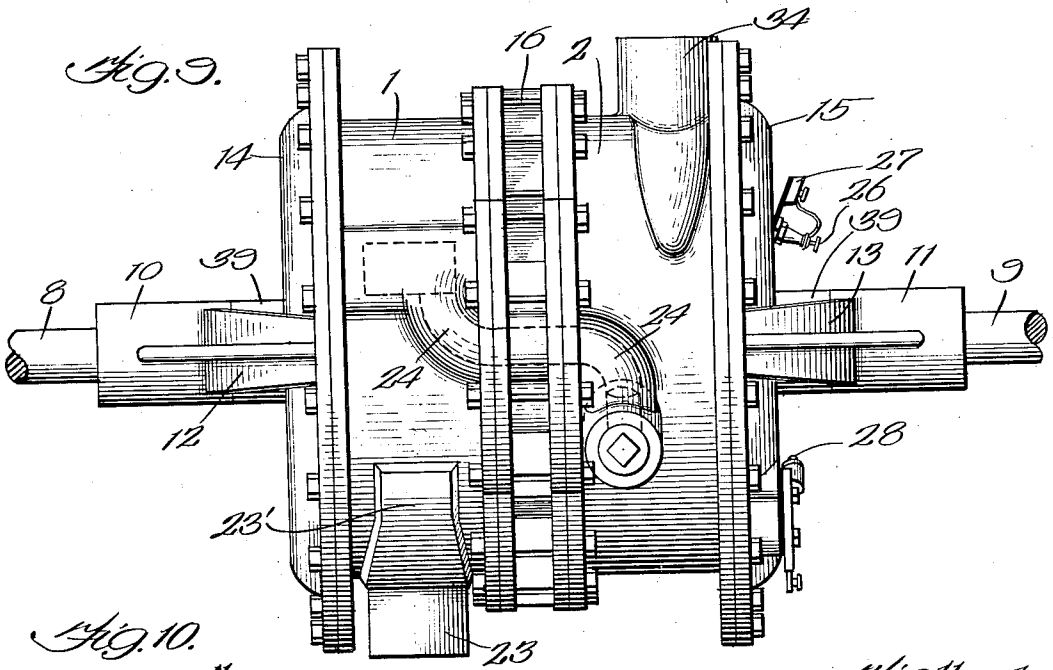


Fig. 10.

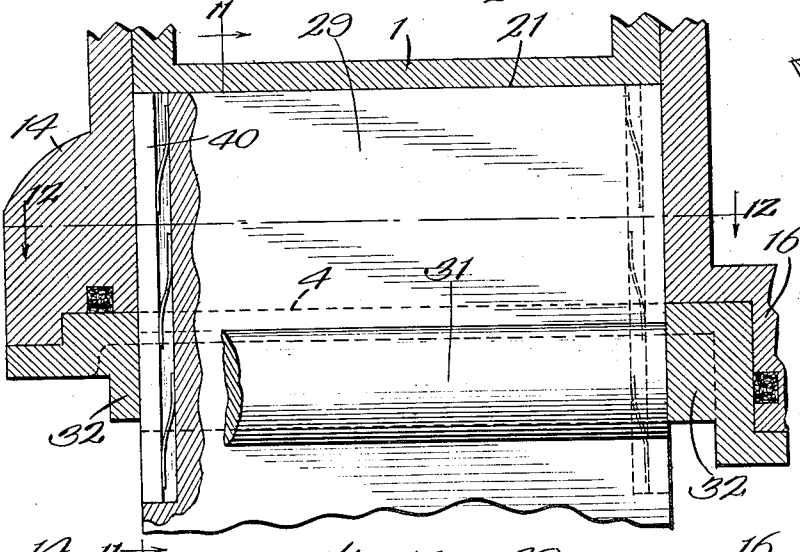


Fig. 11.

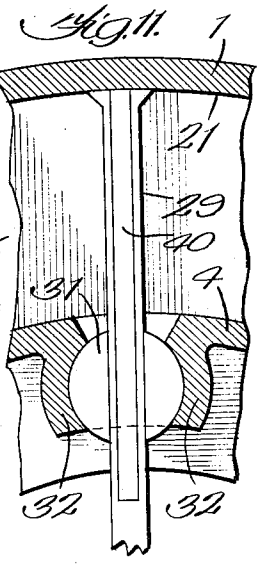
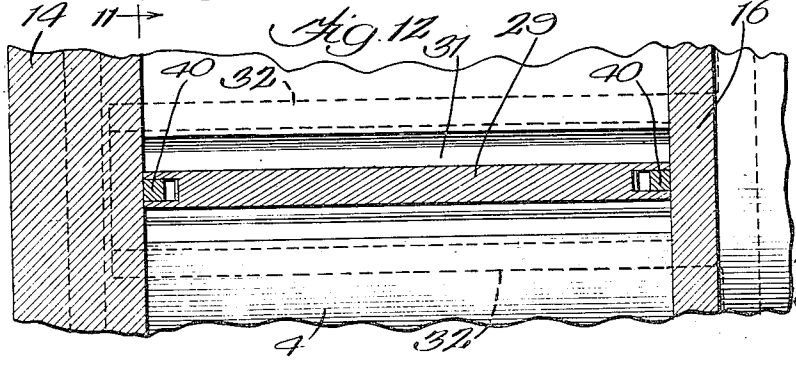


Fig. 12.



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UNITED STATES PATENT OFFICE.

EMIL G. JOHANSON, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE NORLING ROTARY ENGINE COMPANY, OF PIERRE, SOUTH DAKOTA, A CORPORATION OF SOUTH DAKOTA.

INTERNAL-COMBUSTION ENGINE.

1,306,699. Specification of Letters Patent. Patented June 17, 1919.

Application filed June 11, 1917. Serial No. 173,919.

To all whom it may concern:

Be it known that I, EMIL G. JOHANSON, subject of the King of Sweden, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description.

My invention relates to internal combustion engines and has for its object the provision of improved means for compressing charges of gas that are to be exploded in the exploding portion of the engine.

In practising my invention I employ blades that revolve in the cylinders of the engine, some of these blades pertaining to the gas compressing portion of the engine and other blades pertaining to the gas exploding portion of the engine. The blades in the gas compressing portion of the engine are brought closer together in the gas compressing operation more rapidly and effectively to secure compression.

To obtain proper balance of the engine, simplify its construction and to improve the operation of the exploding portion of the engine, the blades in both engine portions are caused to move in unison.

There are features of construction that are not to be limited to internal combustion engines.

I will explain my invention more fully by reference to the accompanying drawings showing the preferred embodiment thereof and in which Figure 1 is an end view of an engine constructed in accordance with the invention; Fig. 2 is a side view; Fig. 3 is a view on line 3—3 of Fig. 1; Fig. 4 is a view on line 4—4 of Fig. 2; Fig. 5 is a view on line 5—5 of Fig. 2; Fig. 6 is a view on line 6—6 of Fig. 2; Fig. 7 is a view showing the other side of the engine opposite to that illustrated in Fig. 1; Fig. 8 is a view illustrating a form of sparking plug that may be employed; Fig. 9 is a view taken from beneath; Fig. 10 is a view generally in section with parts broken away illustrating a detail of construction which is preferred; Fig. 11 is a view on line 11—11 of Fig. 10; and Fig. 12 is a view on line 12—12 of Fig. 10.

Like parts are indicated by similar characters of reference throughout the different figures.

The cylinder 1 pertains to the intake and compression portion of the engine. The cylinder 2 pertains to the explosion and exhaust portion of the engine. These two cylinders are desirably alined and are stationarily supported upon a pedestal 3. The rotor portion of the engine includes a revoluble cylinder 4 that pertains to the intake and compression portion of the engine and a revoluble cylinder 5 that pertains to the explosion and exhaust portion of the engine. These two cylinders 4 and 5 are mechanically connected, being preferably in fixed alinement. The internal cylinders 4 and 5 carry brackets 6 and 7 that are in fixed relation therewith and to which the engine shaft structure is secured, the engine shaft being illustrated as being formed in two sections 8 and 9 respectively fixedly secured to the brackets 6 and 7 so as to rotate with the cylinders 4 and 5. The shaft sections 8 and 9 rotate in stationary bearings 10 and 11 which are secured by the spiders 12, 13 that are carried by the stationary end plates 14 and 15. The cylinders 1 and 2 are separated in part by an annular diaphragm 16 which is concentric or co-axial with the cylinders 4 and 5. This annular diaphragm 16 is provided with packing rings 17, 18 upon its end faces which respectively engage the inner end faces of the inner end walls of the cylinders 4 and 5 whereby gastight separation between the portions of the external cylinders 1 and 2 that surround the cylinders 4 and 5 is effected. The end walls 14 and 15 of the cylinders 1 and 2 are annular, the inner surfaces of these end walls being concentric with the cylinders 4 and 5. Packing rings 19 and 20 are carried by the end walls 14 and 15 and engage the cylinders 4 and 5. The cylinders 4 and 5 are eccentric with respect to the cylinders 1 and 2 whereby crescent-shaped spaces 21, 22 respectively intervene between the cylinders 1 and 4 and between the cylinders 2 and 5. The gas is admitted to the space 21 through the intake 23 and is compressed in a portion of this space as will be set forth. The compressed gas is discharged from the space 21 into the space 22, in which latter space the explosions are to occur. The transfer of the gas from the space 21 to the space 22 is effected through the communicating passage 24, a check valve 25 being included in this passage that permits the flow of gas from the space 21 to the space 22 but prevents

return flow. After each charge of gas has been supplied to the explosion space 22 it is ignited by a spark plug 26. In the embodiment of the invention illustrated three explosions occur for each revolution of the rotor 4, 5, on which account I employ three spark plugs 26 separated 120°. These spark plugs are carried by the rotor and project into the explosion space 22. A contact making and breaking cam block 27 is coupled with each spark plug structure and is engageable with a spring presser contact plunger 28 to establish a spark plug circuit, the established circuit being broken when the engaging contact 27 passes beyond the plunger 28. Thus the plunger 28 is included in circuit three times for each revolution of the rotor but each time with a different spark plug whereby three successive charges of gas are successively exploded per revolution of the rotor.

The gas compression portion of the engine is provided with a plurality of compressing blades 29 that are mounted to oscillate upon a rod 30 that affords an axis of movement for the blades 29 which is concentric with the cylinder 1. The axis of movement of these blades is, therefore, eccentric with respect to the cylinder 4. The blades project through the cylinder 4 across the space 21 and in order that the blades may slide transversely with respect to the cylinder 4 and oscillate with respect thereto without permitting gas to escape through the cylinder 4 where the blades pass therethrough, I employ cylindrical and rotatable packing boxes 31 through which the blades 29 diametrically project and which are in gastight engagement with the blades 29 and correspondingly formed bearings 32 integrally made with the cylinder 4. When each blade 29 reaches the position *a*, Fig. 4, compression commences, the next blade 29 in advance of the blade reaching the position *a* then being farthest from the blade at *a*. At this time these two blades are at the largest part of the space 21. As the rotor continues in movement the blades 29 turn at their bearings 31 to decrease the space between these blades, to effect compression of the gas trapped between these blades. This decrease in the space between these blades progresses as the blades move toward the right hand horn, Fig. 4, of the crescent-shaped space 21 so that the space in which the gas is being compressed is rapidly reduced not only by forcing the gas into the smaller portion of the space 21 but also by the reduction of the space between the blades between which the gas is being compressed. After the gas has been compressed into the right hand portion of the space 21, Fig. 4, the leading blade passes over the passage 24 to establish communication between the space 21 and such passage 24 whereby the compressed gas passes through the passage and by the check valve 25 into the explosion space 22 (Fig. 5), the explosion occurring in the right hand portion of this explosion space that is partitioned off from the balance of this space 22 by one of the blades 33, one of the spark plugs 26 functioning to explode the gas in this part of the explosion space 22 when the charge of compressed gas is fully admitted thereto. The check valve 25 serves to prevent the return flow of gas being exploded and prevents the return flow of the gas after it has been exploded. The succeeding blade 33 scavenges the gas that has been exploded and when the first blade 33 reaches the exhaust passage 34 the spent gas is discharged. The blades 33 are preferably mounted upon the rod 30 that affords an axis of movement for the blades 33 which is concentric with the cylinder 2. The axis of movement of these blades is, therefore, eccentric with respect to the cylinder 5. The blades 33 project through the cylinder 5 across the space 22 and in order that the blades may slide transversely with respect to the cylinder 5 and oscillate with respect thereto without permitting gas to escape through the cylinder 5 where the blades pass therethrough, I employ cylindrical and rotatable packing boxes 35 through which the blades 33 diametrically project and which are in gastight engagement with the blades 33 and correspondingly formed bearings 36 integrally formed with the cylinder 5. When each blade 33 reaches the extreme left hand position shown in Fig. 5 the explosion occurs. By this arrangement of parts it will be obvious that the rod 30 does not partake of any bodily movement in response to the rotation of the shaft sections and the internal cylinder. Furthermore this arrangment greatly simplifies the mounting of the rod and blade in place. The extreme left hand blade 33, before receiving the force of an explosion, commences to scavenge the previously exploded charge, one blade side scavenging while the other side receive the force of the explosion. This blade 33 and the one in advance thereof, by reason of the described mounting of the blades 33 upon the rod 30, have the space therebetween reduced so as to reduce the portion of the space 22 containing the spent gas to promote the ejection of such spent gas through the exhaust passage 34. I do not, however, limit myself to this arrangement of the blades 33 but this arrangement is preferred for the purpose stated and inasmuch as such arrangement enables me to use the same rod 30 upon which all of the blades are mounted.

The rod 30 may be suitably positioned. In the embodiment of the invention illustrated it is provided with rollers 37 upon its ends, these rollers operating within circular

spaces 38 provided in the caps 39 for the shaft sections 8, 9. These spaces 38 are concentric with the cylinders 4 and 5 but the parts thereof that happen to contain the rollers 37 are co-incident with the axis of the cylinders 1 and 2.

The blades may be provided with suitable spring pressed packings 40 at their radial edges, it not being required to provide any packing at the outer horizontal edges of the blades.

The engine is air cooled by the employment of the construction illustrated as the internal cylinders 4 and 5 preferably have no imperforate end walls.

By reference to Fig. 5 it will be observed that the torque occasioned by the exploded gas is substantially uniform since the blade portion initially receiving the impact of the explosion is small and in a small part of the space 22, the part of this blade that projects into the space 22 increasing as the blade progresses into the larger part of the space 22. The area of the blade that is subject to the exploded gas thus increases as the gas expands to compensate for the reduction in the gas pressure. By reference to Fig. 4 it is to be noted that the intake passage 23 has a continuation 23^1 extending to the left hand horn of the crescent shaped space 22. The intake passage continuation 23^1 clears the blades 31 from gastight engagement with the cylinder 1, this clearance being maintained until the blades reach the position *a*. The purpose of the intake continuation 23^1 is to prevent retardation of the engine rotation that would follow if the openings 23^1 were absent.

While I have herein shown and particularly described the preferred embodiment of my invention I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention, but having thus described my invention I claim as new and desire to secure by Letters Patent the following:—

1. Apparatus of the class described including an external cylinder, an internal cylinder eccentric with respect to the external cylinder and rotatable therein, a shaft formed of separated sections connected respectively with the end walls of the internal cylinder and forming in conjunction with the latter seats at the ends of the internal cylinder disposed in circumscribing relation to respective shaft sections, blades passing through the internal cylinder into engagement with the external cylinder, and a rod having its ends disposed respectively in said seats to permit bodily shifting movement of the rod and upon which latter said blades are mounted to swing.

2. Apparatus of the class described including an external cylinder, an internal cylinder eccentric with respect to the external cylinder and rotatable therein, a shaft formed of separated sections connected respectively with the end walls of the internal cylinder and forming in conjunction with the latter circular seats at the ends of the internal cylinder, blades passing through the internal cylinder into engagement with the external cylinder, and a rod having rollers on its ends disposed respectively in said seats and upon which rod said blades are mounted to swing.

In witness whereof, I hereunto subscribe my name this seventh day of June A. D., 1917.

EMIL G. JOHANSON.