B. CONKLIN.

INTERNAL COMBUSTION ROTARY ENGINE.

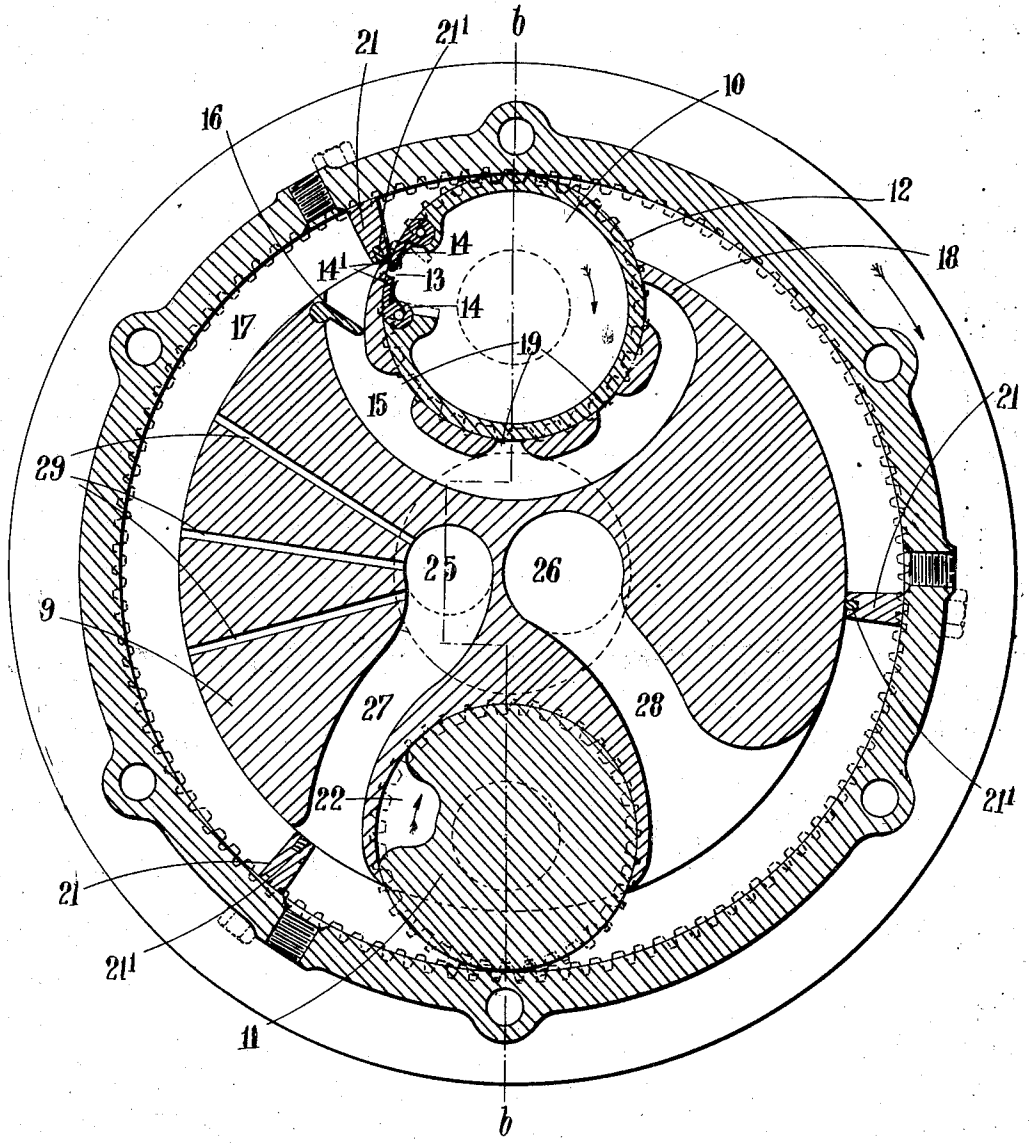
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1,246,885.

Patented Nov. 20, 1917.

3 SHEETS—SHEET 1.

Fig. 1.



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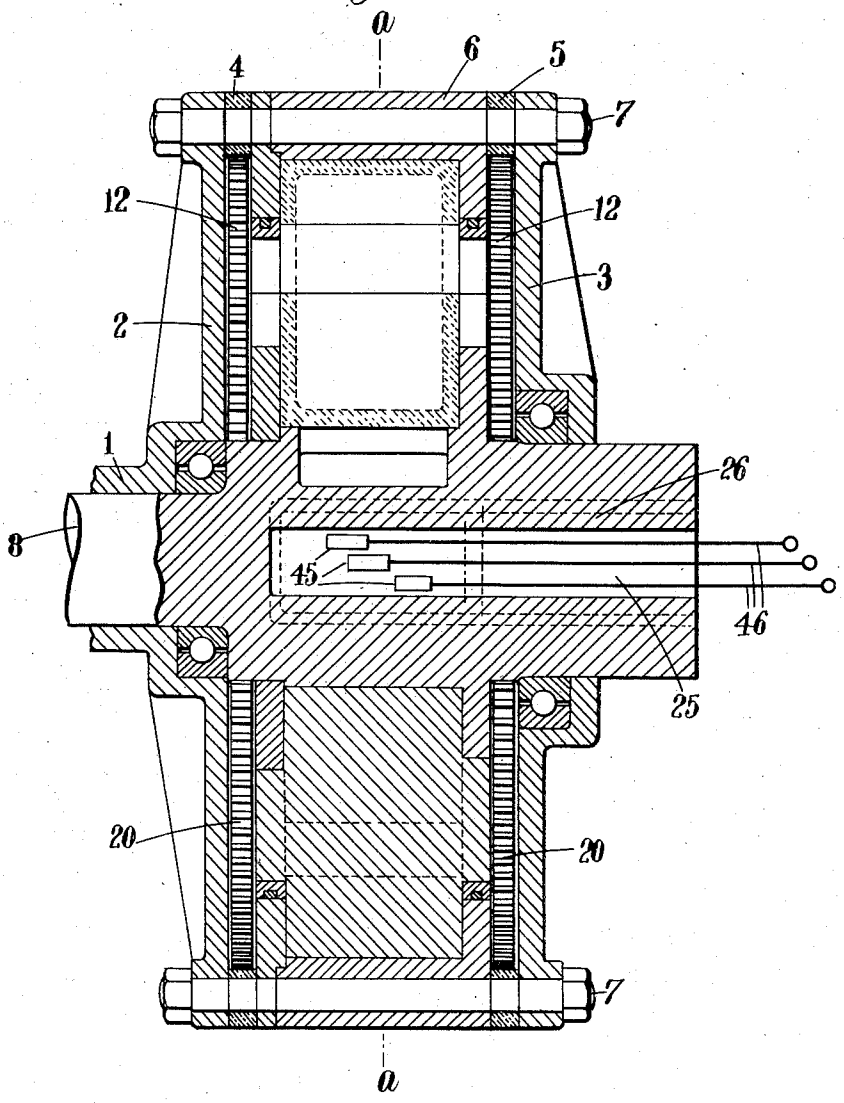
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3 SHEETS—SHEET 2.

Fig. 2.



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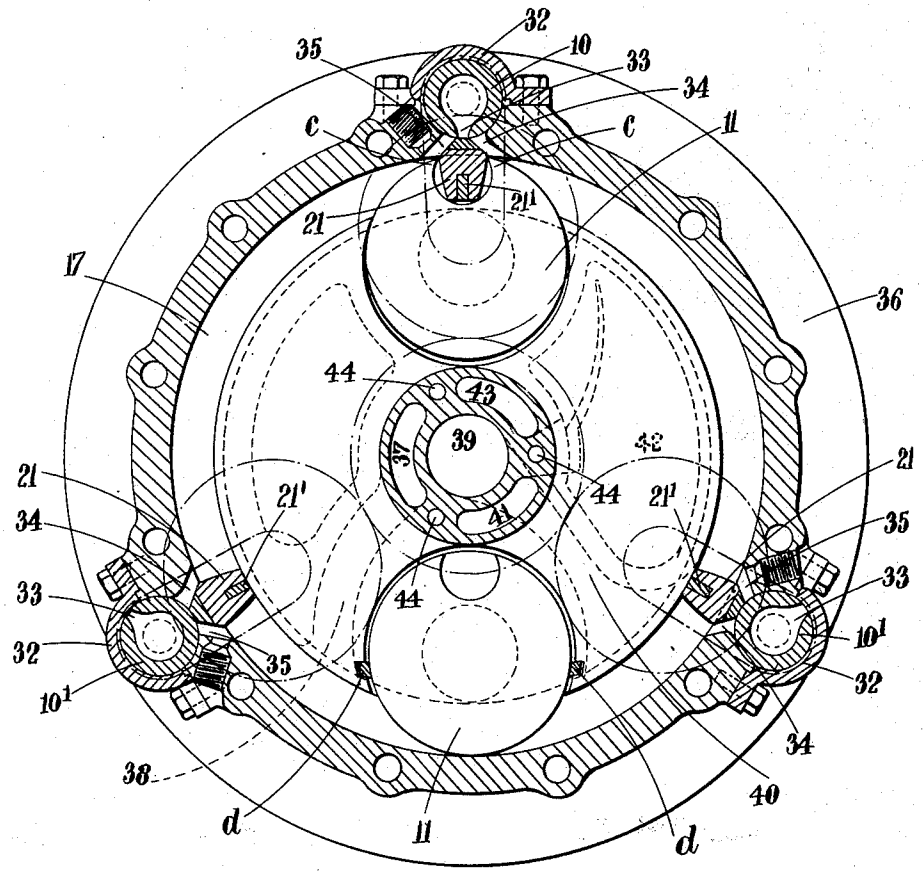
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3 SHEETS—SHEET 3.

Fig. 3.



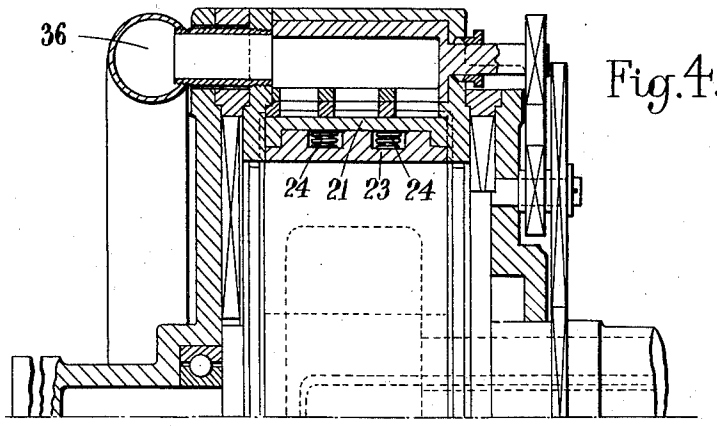


Fig. 4.

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ROTARY ENGINE.

1,246,885. Specification of Letters Patent. Patented Nov. 20, 1917.

Application filed September 16, 1914. Serial No. 862,630.

To all whom it may concern:

Be it known that I, BRUCE CONKLIN, a citizen of the United States of America, residing at Westminster, in the county of Middlesex, England, have invented a new and useful Improvement in and Relating to Internal-Combustion Rotary Engines, of which the following is a specification.

This invention has reference to explosive engines of the rotary type in which the impulse from successive explosions causes rotation of the rotary drum of the engine, and relates more particularly to an engine of that kind in which the rotatable element is provided with radial vanes which coöperate with synchronously rotated valves to compress the charges at one stage in the movement of the element; and to receive the impulses from the explosions at another stage.

The invention has for one of its objects to improve and simplify the construction of engines of the aforesaid type whereby they may be rendered more efficient in operation.

Further objects are to provide an engine in which there shall be no large masses of metal in surface contact, or in other words to so construct the engine that friction between the moving parts shall be reduced to a minimum as by this means troubles arising from expansion due to the high temperature of the combustion gases will be obviated to a large extent.

In its broadest aspect my invention contemplates an internal combustion rotary engine comprising two elements relatively movable in an angular direction one of said elements having a plurality of rotary recessed abutments and the other of said elements a plurality of vanes the arrangement being such that between the rotating parts removable packing strips or rings are arranged so that the parts in actual contact are of very small area. In other words the construction is such that if the packing strips and rings are removed there will be no parts in contact except the face contact of the rotary abutments with the outer casing and the contact at the antifriction bearing which is provided between the two elements.

The aforementioned and other objects as may hereinafter appear or are incidental to the invention are attained by the means which I will now proceed to describe in detail for the ready understanding of which reference should be had to the accompanying drawings in which:

Figure 1 is a section of a rotary internal combustion engine embodying the invention taken on the line *a*—*a* of Fig. 2.

Fig. 2 is a section on line *b*—*b* Fig. 1.

Figs. 3 and 4 illustrate a modification.

In the embodiment of the invention illustrated in Figs. 1 and 2 the power shaft 1 or a sleeve thereon carries a cylinder comprising two end shields 2 and 3 two internally toothed rings 4 and 5 and an annular wall 6 assembled and bolted by bolts 7 in such a manner that the toothed rings 4 and 5 are located at opposite ends of the cylinder adjacent the end shields.

Passing concentrically through the cylinder thus formed is a shaft 8 to which a drum 9 is secured said drum being in the construction illustrated scalloped or hollowed out at two diametrically opposite points to accommodate two rotatably mounted abutments 10 and 11 one of which 10 constitutes a rotary valve and the other 11 a rotary seal. The drum is provided with packing rings to secure gas tight engagement with that part of the outer cylinder with which it comes in contact.

The rotary abutment 10 is in the form of a hollow drum and carries at each end a gear 12 meshing with the respective toothed ring 4 or 5 built into the main cylinder. A slot 13 (Fig. 1) is provided in the rotary abutment 10 and extends in a direction parallel with the axis thereof and at each side of said slot a pivoted member 14 under the control of a spring 14′ is so mounted that when in the outermost radial position said members conform to the cylindrical contour of the valve cylinder for a purpose to be presently explained.

A compression chamber 15 is formed in the drum 9 adapted to communicate at one end through a non-return valve 16 with the space 17 between the periphery of the drum 9 and the inner wall of the cylinder while the other end is sealed as at 18 but a number of ports 19 are provided in the compression chamber 15 for a purpose hereinafter described.

The rotary abutment 11 is preferably a solid cylinder carrying at each end a gear 20 meshing with the respective toothed ring 4 or 5 built into the main cylinder.

The rotary abutment 10 and the rotary

abutment 11 are free to be rotated in the main drum by the rotation of the outer cylinder and the toothed gear above described, said abutments 10 and 11 each making three revolutions for every revolution of the cylinder. The smooth peripheries of the abutments 10 and 11 make gas tight contact with the smooth bore of the cylinder which latter is provided with three vanes 21 also making gas tight contact by means of a packing strip 21′ with the smooth periphery of the drum.

It may here be stated that the function of the gears above described are not only to positively rotate the parts but to insure that the slot or groove for the reception of the vanes should occupy the correct position as the vanes are successively presented to them and further that it is an important part of the invention that the abutments should run in face contact with and at the same face speed as the outer cylinder so that the seals make one revolution while one vane is traveling through a distance equal to the distance between the centers of any two vanes or in other words the circumference of the abutments should be equal to the distance between the centers of any two vanes.

It will be apparent that with this arrangement it is necessary to make provision for the vanes 21 carried by the rotary cylinder to pass the rotary abutment 10 and the rotary abutment 11 and this is accomplished in the case of the rotary abutment 10 by means of the slot 13 above referred to being so disposed that each vane 21 passes through same and into the abutment during the time the vane is passing from one side of the rotary abutment to the other. In the case of the rotary abutment a groove 22 is provided and so disposed as to allow each vane 21 to pass while both parts are rotating the groove and vane being so shaped that one edge of the groove slides in close contact with one face of the vane as it enters the groove and the other edge of the groove slides in close contact with the opposite face of the vane as it leaves the groove thereby securing a gas tight joint during the passage of the vane from one side of the rotary abutment to the other.

The construction and mounting of the aforesaid vanes is a feature of considerable importance to the successful running of the engine and I will therefore describe same in detail. Each vane 21 (see Fig. 4) is dovetailed into the outer annular wall 6 and is provided with a packing strip 23 adapted to be pressed outwardly by the springs 24 so as to make gas tight engagement with the periphery of the drum 9. In order to prevent said packing strip 23 being displaced when the vane enters either the slot 13 or the groove 22 in the rotary abutments 10 and 11 respectively the vane is made slightly longer than the rotary abutments 10 and 11 as the case may be consequently the ends of the vane and strip contact with and run around on the face of the drum 9.

The drum shaft 8 is provided with two separate bores or ducts 25 and 26 leading into passages 27 and 28 in the drum 9. These passages communicate on opposite sides of the rotary abutment 11 with the chamber formed between the drum and the cylinder in which the vanes rotate. One set of ducts and passages 25 and 27 communicate with the fuel supply and the other set 26 and 28 form the exhaust outlet for the burnt gases.

The operation of the engine constructed as hereinbefore described is as follows, it being of course understood that the drum 9 is stationary and the outer cylinder rotating and the rotary abutments also rotating by means of the toothed gear above described, the arrows on the respective parts indicating the direction of revolution.

At any given instant in a single cylinder engine unit one charge of fuel is being drawn in, a second charge is being compressed, a third charge is undergoing combustion and a fourth charge of burnt gases is being expelled. Following the motion of one vane 21 through a complete revolution and commencing when it is just leaving the slot 22 in the rotary abutment 11, the cycle is as follows: A charge of working fluid having been drawn through the induction ports 25 into the cylinder space 17 in front of the vane 21, the forward motion of the latter compresses the mixture and drives it through the non-return valve 16 into the compression chamber 15 and as the slot 13 in the rotary abutment 10 passes the successive ports 19 the compressed charge passes into the interior of the abutment 10. When the vane 21 reaches the abutment 10 the slot 13 is in position to receive it and said vane passes—while the abutment is rotating—to the other side of the abutment and as the vane commences to leave said abutment on the opposite side the explosive mixture under compression is admitted from the interior of the rotary abutment into the space between the vane (shown in the dotted position in Fig. 1) and the rotary abutment. It will thus be apparent that the rotary abutment serves to transfer the compressed working charge from the front of the vane 21 to the rear of the same vane when this latter is in the position shown in dotted lines in Fig. 1. As the vane leaves the slot in the abutment, said slot is sealed by passing into the compression chamber 15 in the drum and at this instant the charge in a highly compresesd condition is fired and the expansion due to combustion drives the vane 21 forward. The forward motion of the vane 21 during this part of the cycle expels the products of combustion due to the firing of the previous charge and brings the vane 21

into engagement with the slot 22 in the rotary abutment 11 ready to repeat the cycle. Each vane receives one impulse per revolution and since there are three vanes there will be three power impulses per revolution of the cylinder which in this case also operates as a flywheel for the engine.

I will now describe the means employed for obtaining variation of compression of the working fluid so as to obtain a variable stroke engine.

Referring first to Fig. 1 it will be seen that I have provided a plurality of ducts 29 in the drum 9 leading from the induction passage to several different points on the periphery of the drum and each of these ducts is adapted to be controlled by valves 45 (Fig. 2) operated by rods 46 leading to the exterior. These ducts when open and in front of a rotating vane act as relief valves through which a part of the fuel admitted at the main inlet is forced back into the induction passage.

In Figs. 3 and 4 I have illustrated a somewhat modified construction wherein the means for transferring the compressed working fluid to the rear of the vane just prior to ignition is arranged upon the outer cylinder instead of within the drum 9 as illustrated in Figs. 1 and 2.

In this construction the drum 9 is provided with two rotary abutments 11 actuated by gearing similar to that hereinbefore described with reference to Figs. 1 and 2. It will be seen that the recesses in the drum to receive the abutments are made of such size that there shall be a minimum of friction between the rotating parts. In the upper abutment I have shown the recess as making contact with the abutment at the points *c—c* while the lower abutment is shown as located in a recess provided with packing strips *d—d*.

The rotary valve 10′ of which in the example illustrated there are three are located in valve casings 32 carried by the outer cylinder and each of said valves 10′ is provided with a spindle passing through a stuffing box to the outside of the cylinder said spindle carrying a sprocket wheel to which motion is transmitted by any suitable gearing such for instance as chain and sprocket gear.

The rotary valves 10 are each provided with a port 33 and the outer cylinder is also provided with ports 34 and 35 one on each side of each of the vanes 21 and adapted to communicate at certain times with the port 33 in the rotary valve as will now be explained.

Assuming the parts to be in the position illustrated in Fig. 3 it will be seen that the vane 21 at the left of the figure is compressing a charge of working fluid in the cylinder space 17. As the vane approaches the upper of the two abutments 11 the rotary valve is so timed that its port 33 registers with the port 34 and the compressed charge enters the valve which then closes and passes into the storage chamber 36 with which each of the rotary valves communicate. The vane now passes to the other side of the rotary abutment and as it leaves the slot therein the port 33 in the rotary valve registers with the port 35 in the cylinder and the explosive mixture under compression is admitted from the chamber 36 through the valve and into the space between the vane (which now occupies the dotted position) and the rotary abutment. The rotary valve now closes and then the mixture is fired and the expansion due to combustion drives the vane forward. The succeeding operations of the cycle are similar to those described with reference to the construction shown in Figs. 1 and 2 and I therefore do not deem it necessary to repeat them as they will be readily understood by those skilled in the art to which this invention appertains.

The outer cylinder may be provided with cooling fins and a circulation of cooling water is maintained within the drum and one means of effecting such water cooling together with the means for introducing the working fluid and exhausting the products of combustion and the lubrication of the moving parts is shown in Fig. 3.

The drum shaft 8 is provided with a number of bores or ducts communicating with passages in the drum 9. The duct 37 serves for the admission of the working fluid and communicates with the induction port 38 in the drum. The duct 39 communicates with the exhaust port 40 in the drum whereby the burnt gases may be led away. Cooling water is admitted through the duct 41 and after circulating through the jacket 42 formed in the drum escapes through the duct 43. The bores 44 are for the purpose of introducing lubricant to the working parts and these may open into any suitable position in the engine to obtain effective lubrication of the parts.

An engine constructed in accordance with this invention may be utilized to transmit power in either direction of rotation at will as it will be apparent that if the outer cylinder is locked against rotation such as by a suitable brake mechanism the inner drum will then rotate in the opposite direction and power may be transmitted from the drum shaft instead of from the outer cylinder or the shaft or sleeve carrying said cylinder, but in this case it will of course be necessary to modify the arrangements for supplying the working fluid and for exhausting the burnt gases and also for maintaining the circulation of water through the drum.

I claim:

1. An internal combustion rotary engine comprising an inner normally stationary drum having a plurality of rotary abutments and induction and exhaust passages therein, an outer rotatably mounted casing having a plurality of vanes and concentrically mounted about said drum to form an annular working chamber, means for positively rotating said rotary abutment, means for securing a gas tight joint between said abutments and the rotary casing and between said vanes and drum, means for introducing working fluid through the drum to the annular working chamber, means whereby the compressed working fluid is transferred from one side of the rotary abutment to the other, means for igniting the compressed charge and means for exhausting the burnt gases.

2. An internal combustion rotary engine comprising an inner normally stationary drum having a plurality of rotary abutments, induction and exhaust passages in said drum, an outer rotatable casing having a plurality of vanes and concentrically mounted about said drum to form an annular working chamber, a compression chamber to receive the compressed gases, packing rings between said casing and drum, packing strips between said vanes and casing, a gear carried by said casing, pinions carried by said rotary abutments, means for introducing working fluid through the drum to the working chamber, means for storing the compressed working fluid and means for transferring said compressed fluid from one side of said rotary abutment to the other, means for igniting the compressed fluid and means for exhausting the spent gases through the drum.

3. An internal combustion rotary engine comprising an inner normally stationary drum having a plurality of rotary abutments, induction and exhaust passages in said drum, means for circulating cooling water through said drum, an outer rotatable casing having a plurality of vanes and concentrically mounted about said drum to form an annular working chamber, rotary valves mounted on said outer casing, an annular compression chamber exterior of said casing, means for introducing the working fluid through said drum to the working chamber, means for compressing the working fluid into the compression chamber, means for transferring a portion of the compressed gases from said compression chamber to the working chamber, means for igniting said gases and means for exhausting the spent gases through the drum.

BRUCE CONKLIN.

Witnesses:
A. E. WHITE,
S. WESTCOT.