

B. L. RINEHART.
 MEANS FOR PROVIDING EXPLOSIVE MIXTURES.
 APPLICATION FILED FEB. 20, 1914.

1,254,358.

Patented Jan. 22, 1918.

FIG. 1.

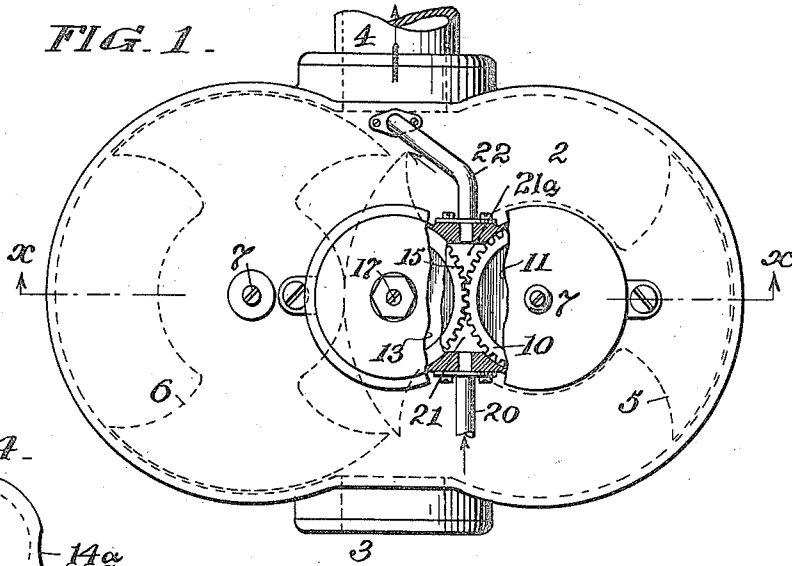


FIG. 4.

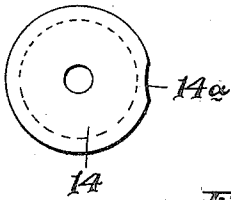


FIG. 2.

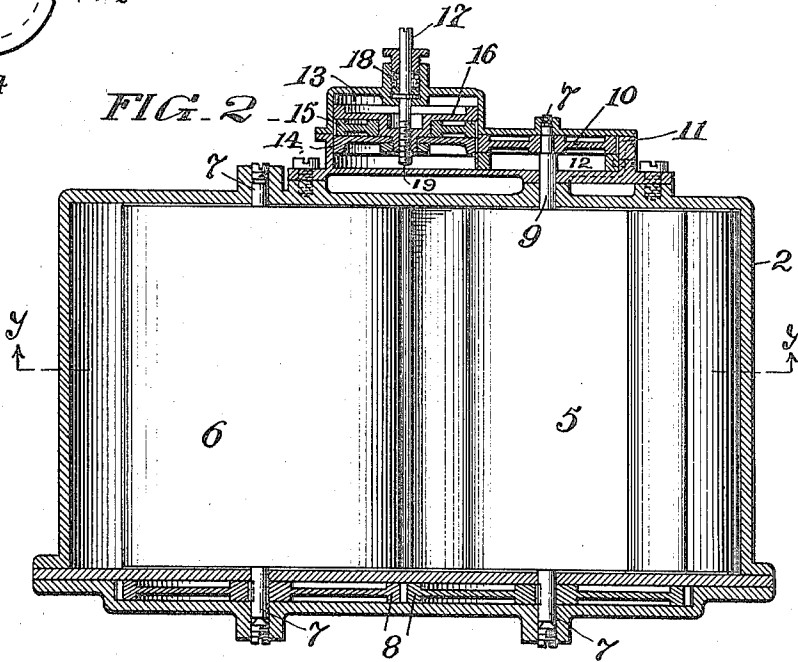
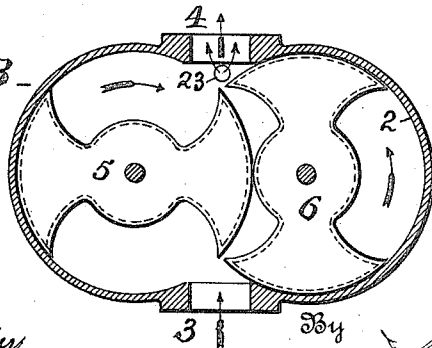


FIG. 3.



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MEANS FOR PROVIDING EXPLOSIVE MIXTURES.

1,254,358.

Specification of Letters Patent.

Patented Jan. 22, 1918.

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To all whom it may concern:

Be it known that I, BENTLEY L. RINEHART, a citizen of the United States, and resident of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Means for Providing Explosive Mixtures, of which the following is a specification.

The object of my invention is to provide a construction of carbureter for gas engines which shall accurately proportion the amount of gasoline or hydrocarbon fluid relatively to the amount of air which is drawn through the carbureter by the operation of the explosive engine, so that, irrespective of the various speeds of the engine an absolutely correct explosive mixture is insured to the engine, and thereby the operation of the engine is made positive and accurate under all varying conditions of speed and loads.

In the ordinary manner of operating carbureters, the air is drawn freely through the carbureter into the engine cylinder, (directly, in a four cycle engine and indirectly through the crank casing, in a two cycle engine) and the rush of the said air is caused to suck in the necessary gasoline or hydrocarbon in a haphazard manner to produce the explosive mixture. As the air suction varies with the different speeds of the engine, it is evident that the composition of the explosive mixture is constantly varying, and therefore causing a defective operation of the engine. When the engine is running very slowly (especially in the case of a two cycle engine), the hydrocarbon fluid is not supplied in sufficient quantities to insure a good explosive mixture. Various means and methods have before been employed for the purpose of assuring approximate proportions of hydrocarbon fluid and air to suit the changing speeds of the engine; thus, for example, as the engine slows down and the suction decreases, the gasoline needle valve is adjusted to open the gasoline supply to a greater extent for permitting a freer flow of the gasoline, and vice versa. Such methods of temporary adjustment are undesirable, first, because they are wholly unsatisfactory and wasteful, and secondly, because they require the constant attention of the operator.

By my improved invention, I provide a carbureter by which an accurate admixture of the air and the hydrocarbon fluid is required to take place for all speeds of the engine, so that at no speeds is there any ma-

terial variation in the actual composition of the explosive mixture which is fed to the cylinder.

My improved carbureter is so constructed that no variation in the amount of suction in the engine can affect the relative quantity of gasoline or other hydrocarbon which is supplied automatically to any given quantity of air, and for this reason, my improved carbureter is adapted to any engine, whether two cycle or four cycle, and operates under the same accurate conditions, irrespective of the speed of the engine or any variations in its speed or load. Furthermore, my improved carbureter requires no adjustments and consequently can be applied and used by any "novice" without the least possibility of its failing to insure the predetermined requirements.

My invention, in its preferred form, consists of a carbureter comprising a body having rotatable air measuring parts which are formed so light in weight and properly suspended that they revolve freely under the suction of the engine, automatically running faster or slower as the speed of the engine increases or decreases. These parts are preferably propelled by the rush of the air through the carbureter under the suction produced by the engine and constitute the air measuring devices thus stated. With these air measuring devices I combine hydrocarbon fluid measuring devices, so formed as to measure definitely predetermined amounts of hydrocarbon fluid with each revolution of the air measuring devices, said fluid measuring devices being coupled or geared to the air measuring devices so as to be driven thereby.

By means of this combination of air driven and measuring devices and hydrocarbon fluid measuring devices, a definite and predetermined quantity of hydrocarbon fluid is pumped or fed into the definite measured quantity of air with each revolution of the air measuring devices, so that the rate of supply of hydrocarbon fluid is at all times accurately proportioned to the rate of supply of the air from the carbureter to the engine.

I further provide my improved carbureter devices above stated with means for regulating the relative proportions of the hydrocarbon fluid to the measured quantities of air so that the carbureter may be adjusted to suit special conditions of the atmosphere,

for producing the most satisfactory results as to the power of the explosion for any given quantity of the mixture, but after said adjustment, the carbureter continues to operate to accurate measures both the quantities of air and hydrocarbon fluid, and force them into admixture preliminary to being supplied to the engine.

My invention also comprehends details of construction which, together with the features above specified, are more fully described hereinafter and defined in a claim.

My improvements will be better understood by referring to the drawing in which: Figure 1 is a side elevation of a carbureter embodying my improvements with a portion broken away; Fig. 2 is a sectional plan view of the same, taken on line $x-x$ of Fig. 1; Fig. 3 is a sectional elevation of the same taken on line $y-y$ of Fig. 2; and Fig. 4 is a plan view of a disk of the hydrocarbon pump mechanism.

2 is the casing of the air measuring devices and as shown is substantially as if two cylinder cases were merged together side by side and opening into each other. 3 is an inlet to the interior of the casing and 4 is an outlet (preferably at the top) and connects, ordinarily, with the intake pipe of the engine. Within each of the two cylindrical portions of the casing is arranged a freely revolving measuring cylinder, said cylinders journaled in the casing at 7, and geared together by gearing 8. These cylinders are respectively marked 5 and 6 and have inner and outer cylindrical portions, the latter closely approximating the diameter of the casing portions and the former being so arranged that the inner diameter of one cylinder coöperates with a portion of larger diameter of the other cylinder, and vice versa, to form a relatively closed direct passage from the inlet to the outlet and thereby causing the cylinder portions to oppositely rotate in a manner to deliver measured quantities of air from the inlet to the outlet with each revolution. The general construction of these air measuring devices is somewhat similar to the well known pressure blowers, but are lighter in construction and more accurate in fit, with a greatly decreased resistance, as in this case the rotating cylinders are preferably required to be rotated and perform work by the suction of the air passing from the inlet to the outlet, whereas in the blowers a positive power by belt, or otherwise, is employed to forcibly rotate the rotatable members to produce a pressure of the air. In the case of my improvement, the air passes through the casing at substantially atmospheric pressure, instead of under compression as in blower apparatus.

The construction of the rotatable members or cylinders 5 and 6 is such that the recessed

portions thereof measure a definite quantity of air with each revolution and transfer the air so measured from the inlet 3 into the space or chamber communicating with the outlet 4, where the hydrocarbon fluid is introduced by the orifice 23. In practice, I prefer to make the rotatable members 5 and 6 of sheet metal so that they are very light and capable of freely rotating under the draft produced by the suction of the engine. Each revolution of the rotatable members 5 and 6 measures a definite quantity of air, and this is true, irrespective of variations in speed of revolution.

Combined with the measuring devices for the air, above described, I provide measuring devices for the hydrocarbon fluid and these latter are positively operated by the former so that their speeds are proportional to each other and commensurate with the duty to be performed. While the measuring device for the air is a motor, the measuring device for the hydrocarbon fluid may be essentially a pump and is mechanically driven by the motor. I will now describe a suitable measuring or pumping device which is of that construction which I prefer in practice for accomplishing the purpose of my invention. 11 is a case formed of two cylindrical portions blending into each other, as is customary in rotary gear pumps, but in this instance they are much deeper than the thickness of the interengaging gears 10 and 15, the cylindrical portion containing the latter being made much the deepest, as indicated at 13. The gear 10 is connected with and rotated by a shaft 9, which is an extended portion of the rotatable air measuring member 5. Arranged in the casing 11 below the gear 10, is an annular or ring part 12, which is stationary and having a curvature which corresponds to that of the perimeter of the gear 10, and between which and the outer wall of the case 11 the gear rotates. The gear 15, which meshes with the gear 10, is preferably of the same diameter and also snugly fits the case portion 13 as to diameter. This gear 15 is journaled between the follower disk portions 14 and 16, the latter being circular and of a diameter equal to the perimeter diameter of the gear 15, and the former being of similar diameter but having a curved notch or recess 14^a (Fig. 4) through which the teeth of the gear 10 may travel. The disk portions 14 and 16 are secured together and are held against rotating by the gear 10 acting as a spline for the notched portion 14^a of the disk 14. These two follower disk portions 14 and 16 are adjusted axially of the gear 15 by a shaft 17 having a screw-threaded end 19. This shaft is held in a stuffing box 18 so that it may be rotated but at all times forming a liquid-tight connection with the casing. The end of the shaft may be slotted

to receive a screw driver to turn it, or it may be rotatably adjusted in any other manner. By turning this screw-threaded shaft 17, the disks 14 and 16, together with the gear 15, are adjusted in the casing. As shown, only a small portion of the teeth of each of the gears 10 and 15 are in engagement and in this condition only a small measuring or pumping action is accomplished; or in other words, only a small quantity of hydrocarbon fluid is measured with each revolution of the gears. By turning the shaft 17, the gear 15 may be brought more or less into alinement with the gear 10 to increase the extent of engagement and, to a corresponding degree, increase the pumping and measuring action with each revolution of the gears. By proper adjustment, the measuring or pumping action may be from nothing to a maximum with each revolution of the gears and the air measuring members; and whatever the adjusted capacity may be, it will remain the same for all speeds of rotation of the members 5 and 6. Moreover, the relative quantity of hydrocarbon to the air, supplied to the engine, will remain the same for all speeds of the engine, as it should be for the most efficient results.

The disks 14 and 16, acting as followers of the gear 15, prevent escape of the gasoline or hydrocarbon fluid from the control of the gear; and the recessed follower 14 fitting snugly against the curvature of the annular or ring part 12, permits an adjustment of the former over the latter, while maintaining a comparatively liquid-tight joint. The depth of the recessed portion 14^a is equal to the depth of the teeth of the gear 10, as will be readily understood and is to provide a space in which the teeth of said gear may rotate when the pump or measuring device is pumping at less than its full capacity, such as by the adjustment shown.

While rotary gear pumps are well known and ordinarily a detailed description of their method of operation would not be required, it is desirable to point out that such pump operates by displacement due to the intermeshing teeth on the discharge side and that simultaneously therewith the liquid is carried from the supply side by the pockets between the teeth of the gears as they travel around the curved inner wall of the casing. Ordinarily, the amount of the conveyance and displacement is equal and constant and of the full capacity of the pump per revolution, but in my improved pump, the extent of interengagement of the two gears 10 and 15 will dictate or govern the amount of displacement and hence the normal capacity of the pump per revolution for any particular adjustment; and this can be changed by simply turning the adjusting screw 17 in one direction or the other, according to whether

an increased or decreased pumping capacity per revolution is required. The liquid, which fills the spaces between the teeth of the gears and is not displaced on the discharge side, is simply carried around and around, and being non-compressible, acts just as if so much of the gear spaces were filled up or cast solid. This construction of pump has capacity from nothing to the full sum of the spaces between the teeth, which coact to displace the fluid on the discharge side, per revolution of the shaft 9 and gear 10. It is manifest that, while it is most desirable that the gears 10 and 15 should be of the same diameter or pitch, this is not at all essential as the requirements will be satisfied if the teeth are of same pitch and shaped to properly engage; though where one of the gears 15 for example, is of smaller diameter, the tooth spaces are relatively larger and the absolute maximum capacity of the pump would be larger than where both gears are of the same diameter; similarly, the smaller are the gears and larger the teeth, greater will the total capacity of the pump be per tooth displacement, but, of course, the speed at which the pump is rotated must be increased to compensate for the fewer teeth employed.

The hydrocarbon fluid is supplied by pipe 20 from any source and may be delivered under gravity or pressure, and delivered into the inlet chamber or space 21 where it is received by the gear teeth spaces as above described. The hydrocarbon fluid in measured quantities is received in the receiving chamber or space 21^a and delivered by pipe 22 into the discharge orifice 23 where it meets the air supply at the entrance to the discharge outlet 4. It is pointed out that the rush of the air is sufficient to insure quick vaporization of the hydrocarbon fluid to produce a homogeneous mixture, but this is further insured owing to the fact that by the alternate action of the members 5 and 6 in delivering measured volumes of air said air is caused to surge backward and forward in the space near the outlet 4 before escaping therefrom and this aids materially in disseminating the hydrocarbon vapor into a perfect admixture with the air before it passes to the engine.

The essence of my invention is to provide means for accurate admixture of the air and hydrocarbon fluid before it enters the engine irrespective of the speed or changes in speed of the engine, so that whether it is running fast or slow, under light or heavy load, it will always receive a proper mixture to insure development of full power, economical results and accuracy and positiveness in operation.

In this application I make no claim to the hydrocarbon measuring devices, *per se*, or as a pump, because the same is reserved for

a separate application therefor; and for the same reason, I do not restrict myself to any particular construction of measuring mechanism either for the hydrocarbon fluid or the air except as defined in the claim, as these
 5 may be varied as desired so long as they mutually coöperate to insure delivery and ultimate mixing of measured quantities of the elements of the mixture, with or without
 10 capacity for adjustment in the relative proportions of such measured air and hydrocarbon fluid.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

15 In a device of the character stated, a casing having inlet and outlet passages, a pair of freely revoluble intermeshing and geared devices within the casing and between the
 20 inlet and outlet passages thereof for measuring a current of air passing through the

casing said revoluble devices being driven by the passage of the air through the casing, combined with a rotary gear pump positively geared with the revoluble devices so
 25 that it always rotates at the same relative speed as said devices and adapted to feed a fluid in a continuous manner and in measured quantities proportional to the measured quantities of air, means leading from the de-
 30 livery side of the pump into the outlet side of the casing whereby the fluid is delivered and mixed with the measured quantities of air, and means within the pump proper for
 35 adjusting the capacity of the pump for pumping fluid for each revolution thereof.

In testimony of which invention, I hereunto set my hand.

B. L. RINEHART.

Witnesses:

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 HORACE D. REEVE.