Feb. 9, 1926. 1,572,292

J. JOHNSON

CONTROLLING DEVICE FOR TWO-CYCLE EXPLOSIVE ENGINES

Filed May 1, 1923 2 Sheets-Sheet 1

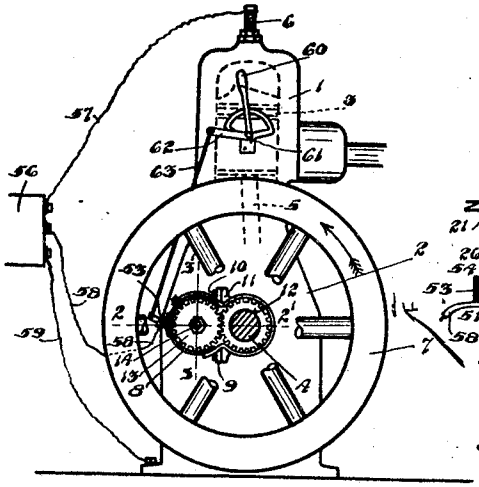


Fig 1

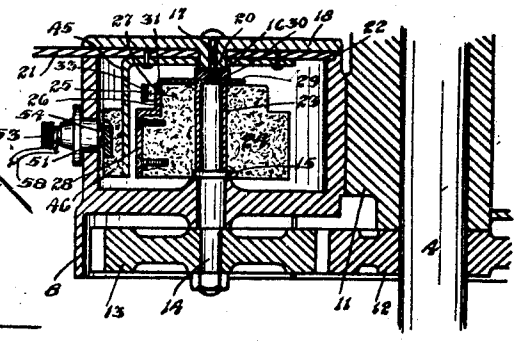


Fig 2

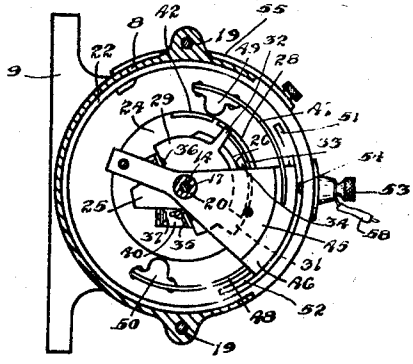


Fig 4

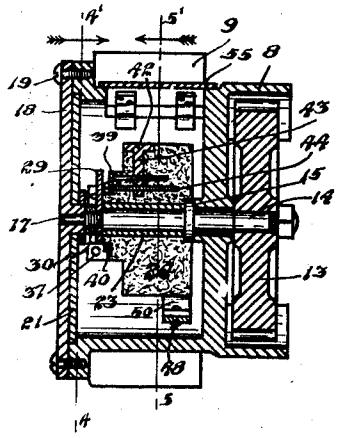


Fig 3

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CONTROLLING DEVICE FOR TWO-CYCLE EXPLOSIVE ENGINES

Filed May 1, 1923 2 Sheets-Sheet 2

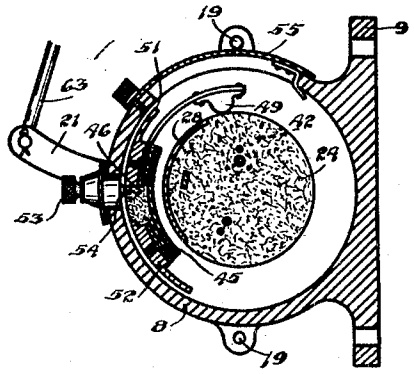


Fig 5

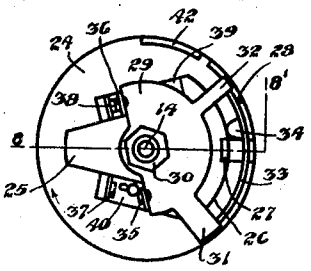


Fig 6

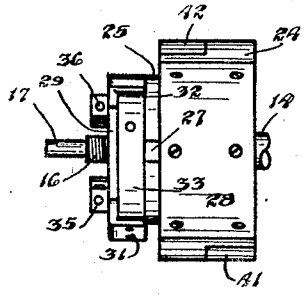


Fig 7

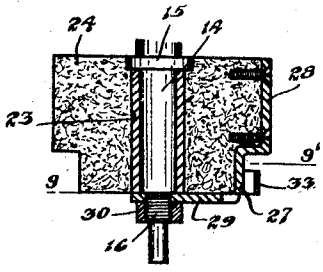


Fig 8

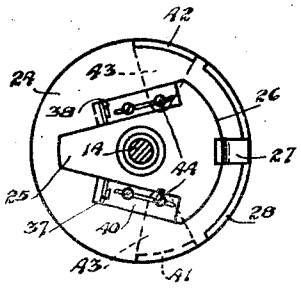


Fig 9

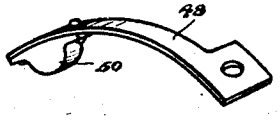


Fig 10

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Patented Feb. 9, 1926. 1,572,292

UNITED STATES PATENT OFFICE.

JOHN JOHNSON, OF PERCIVAL, SASKATCHEWAN, CANADA.

CONTROLLING DEVICE FOR TWO-CYCLE EXPLOSIVE ENGINES.

Application filed May 1, 1923. Serial No. 636,006.

To all whom it may concern:

Be it known that I, JOHN JOHNSON, a subject of the King of Great Britain, of the town of Percival, in the Province of Saskatchewan, Canada, have invented certain new and useful Improvements in Controlling Devices for Two-Cycle Explosive Engines, of which the following is the specification.

The invention relates to improvements in controlling devices for two cycle explosive engines and an object of the invention is to provide a device which can be set to completely and effectively control the operation of the engine and which permits of the positive rotation of the engine in a forward or reverse direction, depending on the setting and also of the stopping of the engine at will and which is arranged also that backfiring is eliminated.

A further object is to construct a device which will avoid having to crank the engine as is customarily done when starting.

A further object is to construct the device so that the spark can be advanced or retarded as desired.

With the above more important objects in view the invention consists essentially in the arrangement and construction of parts hereinafter more particularly described and later pointed out in the appended claims, reference being had to the accompanying drawing in which:—

Fig. 1 is an end view of an engine having the fly wheel broken away to expose my invention, the casing cover having been removed.

Fig. 2 is an enlarged detailed horizontal sectional view at 2—2′ Fig. 1.

Fig. 3 is an enlarged detailed vertical sectional view at 3—3′ Fig. 1.

Fig. 4 is a vertical sectional view at 4—4′ Fig. 3 and looking in the direction of the applied arrow.

Fig. 5 is a vertical sectional view at 5—5′ Fig. 3 and looking in the direction of the applied arrow.

Fig. 6 is an end view of the commutator and parts associated therewith.

Fig. 7 is a side view of the commutator.

Fig. 8 is a horizontal sectional view at 8—8′ Fig. 6.

Fig. 9 is a vertical sectional view at 9—9′ Fig. 8 and looking inwardly.

Fig. 10 is a perspective view of one of the brushes and arm carrying the same.

In the drawing like characters of reference indicate corresponding parts in the several figures.

A two cycle internal combustion engine of any approved type is shown in Fig. 1, the cylinder of the engine being indicated at 1, the crank case at 2 and the piston operating within the cylinder at 3. The piston is connected to the crank shaft 4 in the usual manner by the connecting rod 5 and the upper end of the cylinder is supplied with a spark plug 6. The crank shaft carries the balance or fly wheel 7. My device is located adjoining the protruding end of the crank shaft and is driven by the crank shaft and embodies a cylindrical casing or housing 8 provided with a suitable base 9 which is fastened as by screws 10 to the boss 11 of the crank shaft.

To the forward end of the crank shaft 4 I permanently secure a gear wheel 12 which meshes continuously with a similar gear wheel 13 secured to the forward end of a countershaft 14 which passes centrally through the housing 8 and is rotatably mounted in suitable bearings provided in the front and back of the housing.

It will be observed that the countershaft is provided with a flange or collar 15 immediately within the front wall of the housing and that the rear end thereof is screw threaded at 16 and then contracted to provide a shoulder and a pivot pin 17, the said pin rotatably supporting the rear end of the said shaft.

Further, it will be observed that the back wall of the housing is in the form of a cover plate 18 held in place by removable screws 19 and that the cover plate is provided centrally with an inwardly extending comparatively short hub or boss 20 which forms a pivot point for a setting lever 21, the setting lever extending outwardly through a suitable slot provided in the housing and having the inner end thereof guided in an internal channel 22 provided in the body of the housing.

On the auxiliary shaft I mount a bearing sleeve 23 which has one end engaged with the collar 15 and on the bearing sleeve I mount a commutator 24 formed from insulating material. The commutator has the inner part thereof formed to present a more or less V or wedge shaped end 25, the said wedge shaped end presenting a segmental face 26. Centrally in the face 26 I imbed an exposed contact bar 27 which passes to

the larger part of the commutator and enlarges into an exposed segmental contact plate 28 countersunk in the face of the commutator and extending thereacross.

At the inner end of the sleeve 23 I locate a semi-circular plate 29 which is adapted to rotate with the countershaft, being held in place by being jammed between the inner end of the sleeve 23 and a fastening nut 30 screw threading on the threaded portion 16 of the said shaft. This plate 29 carries a pair of L-shaped arms 31 and 32 Figs. 4 and 6 spaced a predetermined distance apart and having their extending ends overhanging the inner end 25 of the commutator and carrying a spring bar 33 which supports a brush 34 adapted to ride the segmental face 26 and to pass into and out of contact with the bar 27 as later explained.

The plate 29 carries a pair of opposing contact tips 35 and 36 which are adapted, in the rotation of the shaft, to make contact with one or other of a pair of contact tips 37 and 38 Figs. 7 and 9 carried by adjustable bars 39 and 40 secured to the end 25 of the commutator and countersunk in the face thereof.

In this connection I might explain that when the shaft 14 is rotated, say in a clockwise direction as viewed in Figure 6 the tips 35 and 37 are adapted to come into contact and that when said shaft is rotated in the reverse direction the tips 36 and 38 are adapted to come into contact and that further in the continued rotation of the shaft in either direction the contacting tips effect the rotation of the commutator with the shaft.

The commutator carries also a further pair of exposed countersunk contact plates 41 and 42 which are located adjoining the ends of the plate 28 and are insulated therefrom. It will be noted, however, that the said plates 41 and 42 are positioned at opposite sides of the commutator (see Fig. 7) so that a brush in travelling over one of the plates during the rotation of the commutator will not contact with the other of the said plates. The plate 41 is in direct electrical connection with the contact tip 37 through the bar 40 and the plate 42 is in direct electrical connection with the contact tip 38 through the bar 39. Each of the plates 41 and 42 is provided with a lug 43 imbedded in the commutator and the lug is connected to the bar in each instance by one of the bar adjusting screws 44. The screws 44 obviously form an electrical connection between the bars and the plates 41 and 42.

To the setting lever 21 I permanently secure a substantially L-shaped bracket 45 and the free end of the bracket opposes the peripheral face of the commutator and carries a segmental insulating block 46, the ends of which receive and support oppositely positioned spring arms 47 and 48 which carry opposed brushes 49 and 50. These brushes, in the rotation of the commutator, are adapted to pass into and out of contact with the plates 41 and 42. The spring arms and consequently the brushes are in direct electrical connection respectively with the exposed contact plates 51 and 52 countersunk in the face of the insulating block and electrically separated one from the other by the material of the block which extends therebetween. The screws fastening the brush arms 47 and 48 to the bracket 45 are insulated from the bracket by rubber or such like.

The housing or casing carries a terminal 53 which is suitably insulated from the casing and which presents a ball or similar spring pressed contact member 54 which is adapted at all times to ride the outer face of the block so that one can move the setting lever 21 and bring the contact member 54 into contact with either one or other of the plates 51 and 52. The housing is fitted with a removable plate 55 which allows of the ready inspection of the parts.

A coil box 56 of the ordinary type is supplied and the secondary or high tension wire 57 leads from the box to the spark plug 6. The primary wire 58 leads from the coil box to the terminal 53 and a ground wire 59 leads from the coil box and is grounded to the engine.

In a suitable location I locate an operating lever 60. In the present instance this lever is shown as pivotally attached at 61 to the side of the engine and it is provided with an outstanding crank or arm 62 which is connected by an operating rod 63 to the operating lever 21.

In the non-operative or neutral position the lever 60 is in the vertical position and when it is in said neutral position the ball 54 is contacting with that portion of the insulating block 46 lying between the inner ends of the plates 51 and 52. Accordingly the primary circuit is broken and the secondary is non-active. In the drawing the lever 60 is shown shifted slightly to the left and such movement has brought the ball 54 into electrical contact with the inner end of the plate 51 (see Figure 5).

I will now describe the operation of the device, assuming that the engine is running in the direction indicated by the applied arrow Fig. 1 and that the parts are set as shown.

The crank shaft rotates the gear 12 which operates through the gear 13 to drive the shaft 14 in the opposite direction to that 4. The shaft 14, in rotating, carries with it the plate 29 and this plate, in rotating, carries with it the commutator which is driven through the contact of the tips 36

and 38. The commutator in rotating brings the contact plate 42 into contact with the brush 49 and in so doing closes the primary circuit through the contact tips 36 and 38 to the shaft 14 which is grounded to the wire 59.

In this connection it is to be noted that the brush 34 is out of contact with the bar 27 and remains so as such parts rotate at this time as a unit. Accordingly, in the running of the engine, each time the brush 49 sweeps over the plate 42 the primary circuit is closed and the secondary circuit is energized to produce a spark in the cylinder at the spark plug. The time at which the spark occurs in relation to the movement of the piston is determined by the position of the lever 60. In the set position as shown in the drawing the spark is fully retarded and occurs late or a few degrees after dead centre on the explosion stroke. As the lever 60 is swung to the left the spark is advanced for the reason that the brush will sweep over the plate 42 and close the primary circuit at an earlier interval of time in respect to the moving piston. The operation of the engine when running in the opposite or reverse direction is the same as that just described but in this case the lever 60 is to the right of neutral position and the primary circuit is closed through the contacting of the tips 35 and 37 and the sweeping of the brush 50 over the contact plate 41.

In this connection it is explained that when the engine is rotated in the latter direction the plate 29, in turning with the shaft 14 in the latter direction, causes the contact tips 36 and 38 to part and those 35 and 37 to come into contact. When the tips 36 and 38 part the circuit through the brush 49 is broken and that through the brush 50 is made.

The contact tips 36 and 38 and those 35 and 37 in reality form switches controlling the closing of the circuit through the brushes 49 and 50.

This device also operates to positively start the engine rotating in one direction or the other and without any possibility of back-firing, depending entirely on the setting of the lever. It also permits of the reversing of the engine through the manipulation of the lever. Such is now described.

Assuming the engine running in the forward direction or that of the applied arrow Fig. 1, and that it is desired to reverse the same. In doing this one moves the lever 60 to the right past the neutral or upright position. In so doing he shifts the lever 21 to bring the plate 52 into contact with the ball 54 and in so doing he opens or breaks the circuit through the brush 49, which brush is the one that, up to this time, was closing the primary circuit. The spark accordingly ceases but the engine continues to rotate in the forward direction until it has overcome its momentum. On the last turn of the stopping engine the piston will come up against compression and will then move down, rotating in the opposite direction, under compression, and as it does so the contact 34 is swept across the bar 27 and at the same time the contact tips 36 and 38 are parted and those 35 and 37 have not yet come into contact. As the brush 34 sweeps over the bar 27 it connects the said brush with the plate 28 and this plate, in rotating and through contact with the brush 50, closes the primary circuit through the ball contact 54. Accordingly a spark will be produced at the beginning of the down stroke of the piston which will operate to start the engine in the reverse direction. Thereafter the contacts 35 and 37, which, in the reversal of the engine have been brought into contact, operate to close the primary circuit at the proper time through the brush 50 as the said brush sweeps over the plate 41.

On account of the contact tips 35 and 37, 36 and 38 being positively in or out of contact during the manipulation of the engine it is absolutely impossible for there to be any back-firing of the engine.

To stop the engine one brings the lever 60 to neutral position, which action sets the ball contact 54 in contact with that part of the insulating block 46 appearing between the inner ends of the plates 51 and 52. Accordingly there can be no closed circuits through the commutator.

To start the engine one sets the lever 60 in either forward or reverse position and having done this he then grasps the fly wheel and turns it in the opposite direction to the direction of rotation required. This compresses the charge and the compression moves the piston down in the direction that the engine is to subsequently rotate. As the crank shaft turns in this direction the brush 34 is brought into contact with the bar 27 to close the primary circuit through the plate 28 and the brush 49 or that 50, which controls that direction of rotation of the engine. A spark accordingly occurs and the engine starts. Subsequently the spark is controlled through the proper switch or contact points associated with the brush 49 or 50 closing the primary circuit in that direction of rotation.

Whilst I have described the invention as controlling a single cylinder two-cycle engine, it will be readily understood that it could be applied with equal facility to a multi-cylinder two-cycle engine.

What I claim as my invention is:

1. In an automatic spark controlling device for a two cycle explosive engine, the combination with the crank shaft thereof, of a counter shaft driven by the crank shaft, a commutator rotatably mounted on the

shaft and provided with a pair of spaced insulated contact plates, shiftable brushes riding the face of the commutator and engageable with the plates, means for effecting an electrical circuit with one or other of the brushes in the shifting thereof, a rotary plate permanently secured to the counter shaft, pairs of opposing contacts carried by the plate and the commutator, said commutator contacts being in electrical connection with the plates of the commutator and those of the rotary plate being grounded, and the said pairs of contacts forming switches which open and close, depending on the direction of rotation of the counter shaft.

2. In an automatic spark controlling device for a two cycle explosive engine, the combination with the crank shaft thereof, of a counter shaft driven by the crank shaft, a commutator rotatably mounted on the shaft and provided with a pair of spaced insulated contact plates, shiftable brushes riding the face of the commutator and engageable with the plates, means for effecting an electrical circuit with one or other of the brushes in the shifting thereof, a rotary plate permanently secured to the counter shaft, pairs of opposing contacts carried by the plate and the commutator, said commutator contacts being in electrical connection with the plates of the commutator and those of the rotary plate being grounded, and the said pairs of contacts forming switches which open and close, depending on the direction of rotation of the counter shaft, a brush carried by the rotary plate, and means carried by the commutator and adapted to provide an electrical connection between the latter brush and one or other of the other brushes, depending upon the direction of rotation of the counter shaft, such electrical connection being made during the interval that both switches are open.

3. Automatic spark controlling apparatus for two cycle internal combustion engines comprising manually settable means for effecting a spark during continuous rotation of the engine in either direction embodying switches operable by the engine to prevent the occurrence of a spark upon inadvertent reversal of the engine and without disrupting the original setting of said means, and auxiliary means operated by the engine to produce an assisting spark immediately after the reaction of the compressed raw mixture in the cylinder has stopped and reversed the engine, said last mentioned means being brought into operation subsequent to changing the setting of the first mentioned means.

4. Spark controlling apparatus for internal combustion engines comprising means including a manually settable control element for producing a spark during continuous rotation of the engine in either direction, said means including provision for preventing repeated occurrence of a spark when the engine is inadvertently reversed to operate in a direction opposite to that for which the initial setting is made, said manually settable control element being movable to a neutral position to render the aforesaid means inoperative for producing a spark or to either of two operative positions dependent upon the desired direction of engine operation and auxiliary spark producing means operated by the engine and functioning, when said manually settable control element is shifted from one operative position to the other to produce a spark in the cylinder just after the reaction of the compressed raw mixture has effected reversal of the engine, said auxiliary spark producing means being operated automatically by the engine at each reversal thereof.

5. Automatic spark controlling apparatus for two cycle internal combustion engines comprising means for producing a spark during continuous operation of the engine in one direction, means for producing a spark during continuous operation of the engine in the opposite direction, each of said means including an automatically opening and closing switch which is maintained closed by the engine during continuous operation of the engine in one direction and is automatically opened by the engine upon reversal thereof so as to render said means inoperative during such reversing, the two aforesaid means being used alternately dependent upon direction of rotation of the engine and being inoperative to produce a spark upon reversal of the engine, and a main controlling element operable to place either of said means in operation or to render both of said means inoperative so as to permit idling of the engine, and auxiliary spark producing means including a switch operated by the engine to close momentarily each time the engine is reversed by the reaction of the compressed raw material in the engine cylinder.

Signed at Broadview this 7th day of February, 1923.

JOHN JOHNSON.