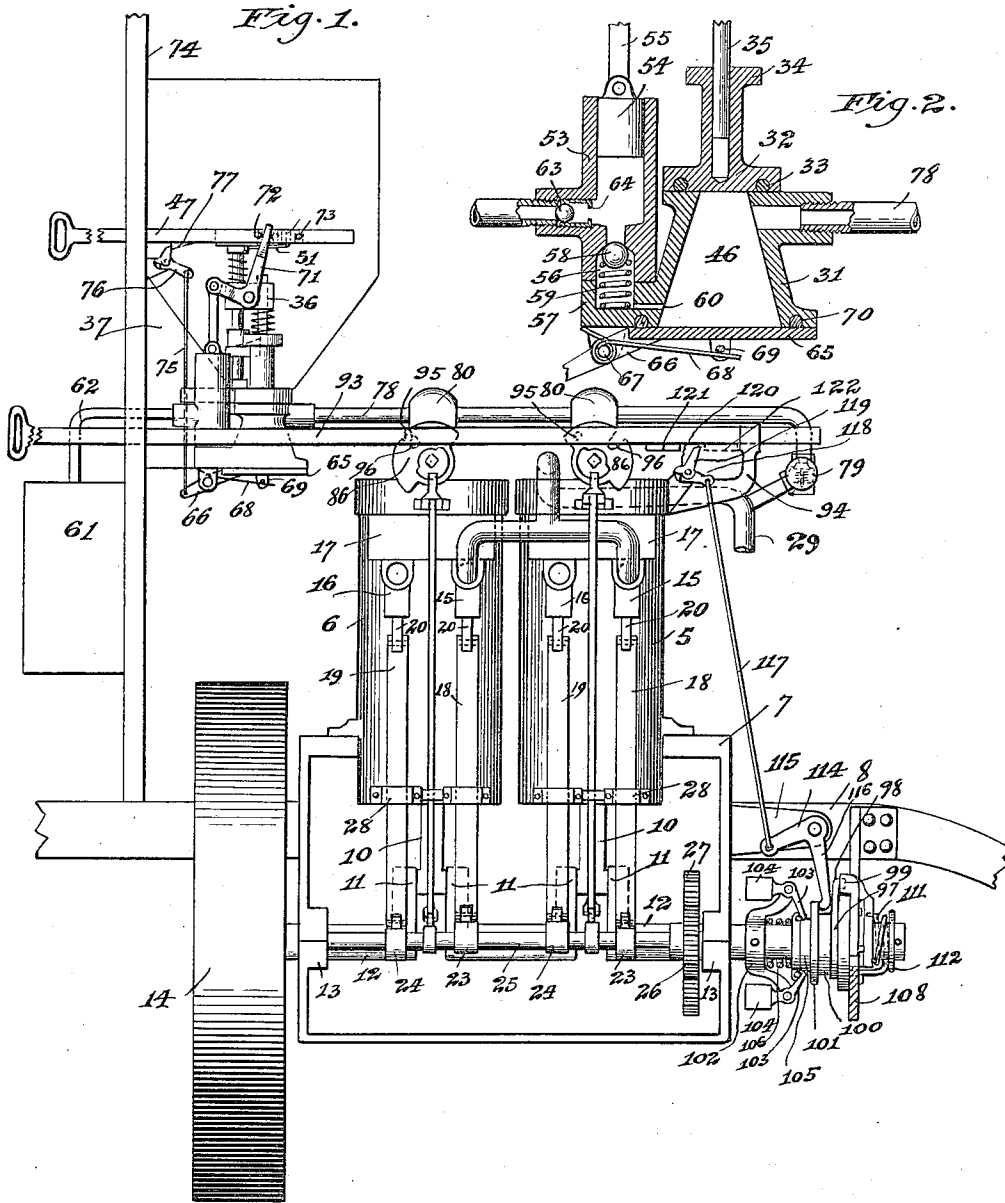


J. A. BROWN & C. G. BOSCH.
 STARTING DEVICE FOR EXPLOSIVE ENGINES.
 APPLICATION FILED MAY 18, 1911.

1,031,908.

Patented July 9, 1912.

2 SHEETS-SHEET 1.



Witnesses,
E. Mann
O. N. Pond

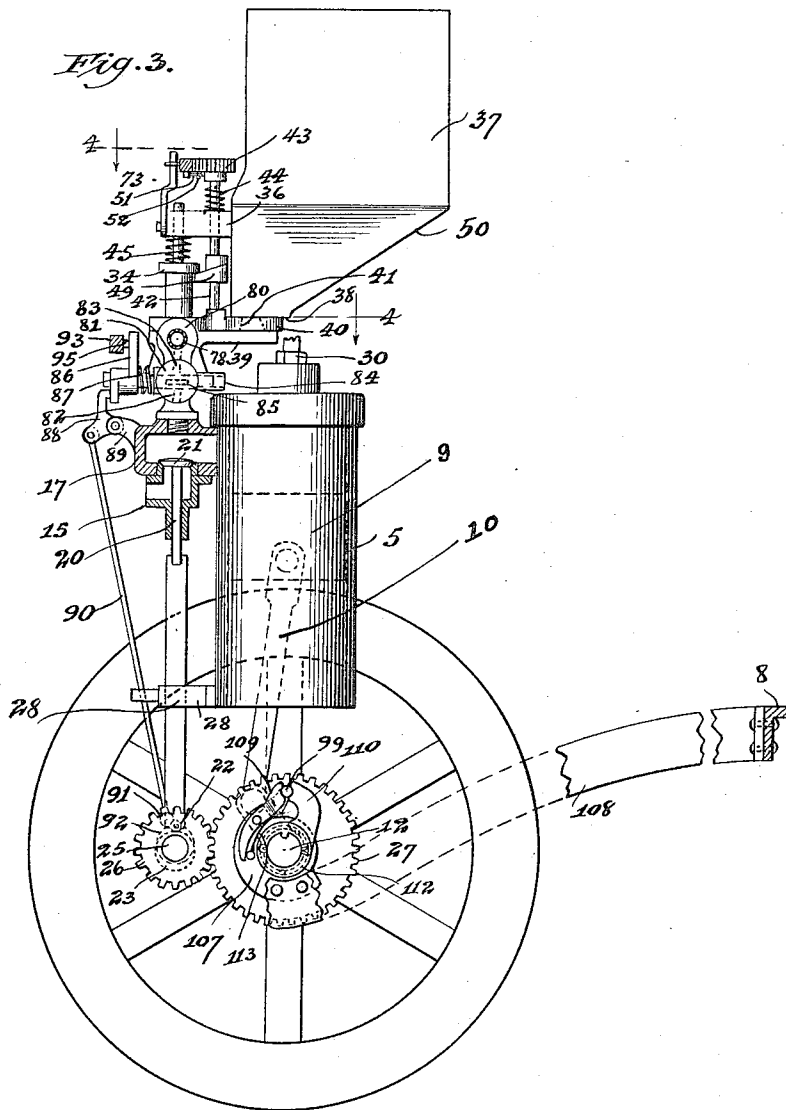
Inventors,
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S. M. Mann
S. N. Pond

Inventors,
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By *Offield, Towle, Grand & Offield*, Attys.

UNITED STATES PATENT OFFICE.

JAMES A. BROWN AND CARL G. BOSCH, OF CEDAR RAPIDS, IOWA, ASSIGNORS TO BOSCH-RHEA COMPANY, OF CEDAR RAPIDS, IOWA, A CORPORATION OF MINNESOTA.

STARTING DEVICE FOR EXPLOSIVE-ENGINES.

1,031,908.

Specification of Letters Patent.

Patented July 9, 1912.

Application filed May 13, 1911. Serial No. 627,969.

To all whom it may concern:

Be it known that we, JAMES A. BROWN and CARL G. BOSCH, citizens of the United States, residing in the city of Cedar Rapids, county of Linn, and State of Iowa, have invented certain new and useful Improvements in Starting Devices for Explosive-Engines, of which the following is a specification.

Our invention relates to a starting device for explosive engines comprising one or more cylinders with the usual parts and means for firing the explosive charge when introduced into the cylinders, in combination with a fuel supply tank adapted to hold an auxiliary explosive charge which may be introduced into one or more of the cylinders for the purpose of obtaining an initial explosion.

It is, of course, well known that with explosive engines it is often difficult to obtain the initial explosion, particularly in cold weather, due to the fact that the gaseous mixture introduced into the cylinders will not ignite, or when ignited, does not give the proper explosion and, therefore, we have devised means for introducing a charge of explosive gases into the cylinder as one of the first steps to be followed in the successful operation of our device. Even in cases where an initial explosive charge is introduced into the cylinders from an auxiliary fuel supply and exploded, the piston in the engine is not moved sufficiently to complete the cycle of the crank shaft and draw a charge of gaseous mixture from the main supply source, which is due to the fact that the piston frequently stops at the point known as "dead center." Where the engine has more than one cylinder it is only by mere chance that the pistons therein stop at the desired point for their successful operation upon the initial explosion when the engine is again started and, therefore, we have devised means, in combination with our auxiliary fuel supply means, whereby one or more of the pistons in an engine having one or more cylinders, will always stop in the desired position and so held until a new charge has been introduced into the cylinder or cylinders and fired.

Our invention further resides in the mechanism hereinafter shown and described for accomplishing the broad general objects of the invention set forth.

In the accompanying drawings, Figure 1 is a side elevational view of our improved starting device applied to a two cylinder explosive engine; Fig. 2 is a sectional view of the fuel and liquid supply receptacles. Fig. 3 is an end elevational view of Fig. 1; Fig. 4 is a detailed plan view on the line 4 of Fig. 3.

Referring now more particularly to the drawings, the explosive engine herein shown is of the ordinary type, consisting of one or more power cylinders 5 and 6 suitably secured to a bed or base 7 forming the crank case that is hung between the side frames 8; each cylinder containing pistons 9, piston rods 10, the lower ends of which are pivotally secured between the arms 11, said arms being rigidly connected to the crank shaft 12. The crank shaft has bearings 13 at either end of the crank case and to one end of the shaft is secured the usual fly wheel 14. Each cylinder is also provided with intake valves 15 and exhaust valves 16 opening into the valve chambers 17 which communicate with the compression chamber of each cylinder. The valves are operated by means of the valve rods 18 for the intake valves and rods 19 for the exhaust valves, being connected at their upper ends with valve stems 20, the latter carrying the valves 21. The lower ends of the valve rods are provided with cam surfaces 22, the cams 23 and 24 coming in contact with the cam ends of the valve rods to alternately open and close the intake and exhaust valves for admitting an explosive charge into the cylinder and its discharge therefrom. The cams 23 and 24 are mounted upon a counter-shaft 25, which carries the gear 26 in mesh with the gear 27, the latter being mounted on the crank shaft. The valve rods are slidably supported in the brackets 28 secured to the cylinders. The main intake pipe 29 leads to a carbureter (not shown) and it is forked at its other end, each fork leading to one of the intake valves. Spark plugs 30 are provided in each cylinder for exploding the gaseous charge drawn into the cylinders through the intake pipe 29.

The engine so far described is one of the common types of gas engines and constitutes no part of our invention, which relates to the means hereinafter described for starting the engine.

Our auxiliary apparatus comprises a fuel

supply receptacle 31 having a removable top wall 32 and an annular packing ring 33 adapted to rest upon the top surface of the fuel receptacle 31 to form a tight joint. An annular shoulder 34 is formed on the removable top wall 32. Secured to the wall 32 is a guide rod 35 sliding through a bracket 36, which is secured to a fuel storage receptacle 37 hereinafter described, or any other suitable part. The fuel storage receptacle is provided with a discharge opening 38, beneath which is a plate 39 and between the plate and discharge opening a conveying plate 40 is disposed which is provided with an opening 41 near one end. The bearing plate 39 is curved and is extended to meet the top surface of the fuel supply receptacle; the top surfaces of both the bearing plate and the fuel supply being in the same horizontal plane.

A shaft 42 is secured to the conveying plate 40 having a bearing in the bracket 36 and carries a segmental gear 43 at its upper end. A spring 44 encircles the shaft 42, one end of which is secured to the shaft and its other end secured to the bracket 36 for holding the conveying plate 40 in its normal position, namely, with the opening 41 beneath the mouth 38 of the fuel storage receptacle 37; and a spring 45 is interposed between the shoulder 34 and the bracket 36 for normally forcing the top wall 32 of the fuel supply receptacle 31 against said fuel supply receptacle, thereby closing the chamber 46 at its upper end. A lever 47 is provided with a rack gear 48 at one end, the teeth of which are adapted to engage the teeth of the segmental gear 43. When the lever 47 is moved to the left, as shown in Fig. 1, the shaft 42 is rotated through the gears so as to shift the opening 41 from underneath the discharge opening 38 and bring the same into registering alinement with the opening at the top of the fuel supply receptacle 31. When the conveying plate is so shifted it is obvious that the top wall 32 must be raised and to accomplish this we secure a cam 49 to the shaft 42 which engages the lower edge of the shoulder 34 when the top wall is seated on the upper edge of the receptacle 31, but when the shaft 42 is rotated the shoulder 34 rides upon the cam surface of the cam 49, thereby lifting the top wall 32 against the action of the spring 45 a sufficient distance to allow the conveying plate 40 to be substituted in its place.

The storage receptacle 37 is provided with a fuel, which for convenience we shall call acetylene carbid, and as the lower wall 50 of the receptacle is inclined the fuel will gravitate toward the discharge opening filling the opening 41 in the conveying plate 40. When the conveying plate 40 is moved the fuel will slide along in the opening 41 upon the plate 39 until the opening at the top of

the fuel supply receptacle is reached, whereupon the fuel will drop into the chamber 46.

In Fig. 4 it will be noted that the teeth on the rack gear 48 are so spaced from the teeth on the segmental gear 43 that the teeth will not engage upon movement of the rack if it were not for a spring latch 51 which is secured to the lever 47, the free end of which engages a pin 52 secured to the gear 43 thereby turning the gear 43 so that the teeth will come in mesh. After the gear 43 has been revolved to the desired point the segmental gear will then have run off of the rack gear thereby permitting the spring 44 to return the conveying plate underneath the discharge mouth 38 and at the same time the cam will drop the top wall 32 thereby closing the upper end of the receptacle 31.

When carbid is used as the fuel to be deposited in the receptacle 31 it is necessary to introduce water into the chamber 46 and for this purpose we have provided a pump consisting of a pump cylinder 53 having a piston 54, and piston rod 55. The lower end of the cylinder is cut away to provide a valve chamber 56 partially formed in the pump cylinder and partially in the wall 57 formed integral with the receptacle 31. The valve chamber is provided with a ball-valve 58, the ball being normally held against its seat by a spring 59. An aperture 60 leads from the valve chamber 56 to the chamber 46. A liquid supply receptacle 61 is connected to the pump cylinder by means of a pipe 62, the discharge end of which is closed by a valve ball 63 retained in a valve casing 64. An upward movement of the piston 54 produces a suction in the cylinder 53 thereby drawing the liquid from the receptacle 61 through the pipe 62 and into the cylinder, whereupon a downward movement of the piston opens the ball-valve 58 and at the same time closing the valve 63, thereby driving the liquid in the cylinder through the aperture 60 into the chamber 46 where it comes in contact with the fuel therein and forms acetylene gas, when carbid is used.

The lower wall 65 of the receptacle 31 is rigidly fixed to a lever 66 pivoted to a suitable point on the receptacle 31 by means of a pivot pin 67 and a spring 68 encircles the pivot pin 67 bearing, at one end, on a lug 69 formed integral with the wall 65, and at its other end against the wall 57; the action of the spring 68 being to normally seat the lower wall against the packing ring 70.

A bell crank lever 71 is pivoted to the bracket 36 and one end thereof is pivotally connected to the piston 55. The upright portion of the bell crank lever extends between the pins 72 and 73 secured to the lever 47, so that when the lever 47 is moved toward the dashboard 74 of the vehicle, the pin 72 strikes the upright portion of the bell crank, thereby raising the piston 54 in the

cylinder 53 and drawing in the liquid supply. Upon reversing the lever, the pin 73 strikes the lever 71 forcing the piston 54 downward and thereby driving the liquid into the chamber 46.

A rod 75 is connected to the lever 66 at its lower end and to a lever 76 at its upper end, so that an outward movement of the lever 47, or to the left, as shown in Fig. 1, causes the shoulder 77 to strike the lever 76, thereby moving the rod 75 upwardly and consequently lowering the bottom wall 65 of the receptacle 31, which discharges the used fuel from the chamber 46.

A communicating pipe 78 is connected to the receptacle 31 opening into the chamber 46 at one end, its other end being connected to the intake pipe 29, and a one-way valve 79 is interposed in the pipe 78 at any suitable point for permitting the fuel to pass into the intake pipe 29 only. Valves 80 are connected to the pipe 78 for controlling the admission of the fuel from said pipe 78 into the cylinders 5 and 6, said valves 80 consisting of a chamber 81 having openings 82 and 83 leading into the valve chamber 17 and the communicating pipe 78, respectively. A valve rod 84 is slidably mounted on the valve 80, said valve rod being provided with a suitable valve opening 85 which is normally in a closed position, or disposed at substantially a right angle to the openings 82 and 83.

Timing plates 86 are secured to the valve rods 84 at one end thereof and springs 87 interposed between the valves 80 and the timing plates 86, which normally force said timing plates away from the valve. The timing plates are actuated by movable bell crank levers 88, herein shown as pivotally connected to the studs 89, one end of the levers 88 being pivoted to its actuating rod 90, which carries a cam 91 at its lower end in contact with a cam 92 fixed to the counter-shaft 25. The action of the cam 92 against the cam end 91 of the actuating rod 90 is to move the timing plate 86 inwardly upon each revolution of the cam 92, the spring 87 moving the timing plate outwardly after the cam 91 has reached the crown of the cam 92. A lever 93 is slidably mounted in the dash 74 near one end and in a bracket 94 near its other end, said lever being arranged parallel to the outer side surfaces of the timing plates 86 and carries pins 95 adapted to enter recesses 96 formed in the timing plates 86. The function of the timing plates is to control the admission of fuel from the communicating pipe 78 to the cylinders, which is accomplished in the following manner: During normal operation of the engine the valve opening 85 is in a closed position, but the rods 90 are continuously being actuated alternately moving the timing plates 86

inwardly. The continuous alternating movement of the timing plates in no way affects the operation of the engine and it is only when the engine is stopped and it is desired to start the same that said timing plates are used.

As will be hereinafter described, mechanism is provided for stopping one of the pistons at a given point in its power stroke. When one of the pistons is so stopped and it is desired to start the engine, the lever 93 is shifted until one of the pins 95 enters one of the slots 96 in one of the timing plates. When the pin and slot are in registering alinement, the spring 87 shifts the timing plate slightly outward, causing the pin 95 to enter the slot 96, whereupon the lever 93 is moved slightly rotating the timing plate, thereby turning the valve rod 84 until the aperture 85 therein is in vertical alinement with the apertures 82 and 83. When in such position the valve is opened and the fuel within the pipe 78 passes through said valve into the valve chamber 17 and from there into the cylinder. In Fig. 1 the timing plate 86 (to the left) is shown with the pin 95 within the slot 96, so that a shifting of the lever 93 to the right rotates the timing plate, thereby opening the valve. As either cylinder may be stopped in its power stroke, it is therefore a matter of chance as to which timing plate will be next engaged when the engine is again started, as the plates are alternately pressed inward, consequently only the plate which is in its outward position when the engine is again to be started will be the one to be shifted. The valve 85 can be left open until the engine is in full operation, receiving its fuel from both the intake pipe 29 and the communicating pipe 78, whereupon by shifting the lever 93 the timing plate 86 will be oscillated through the medium of the pin 95 in the slot 96, thereby rotating the valve rod 84 in the valve 80 and closing the valve opening 85.

As before stated the principal object of our invention is to introduce the fuel from the fuel supply receptacle 31 when one of the pistons in a cylinder is in its power stroke position and with this end in view, we provide the following mechanism: A movable member 97 is slidably mounted on the crank shaft 12 and carries an arm 98 having a forwardly projecting neck portion 99. The movable member is provided with a channel 100 formed by the arm 98 and the shoulder 101. A governor 102 is rigidly fixed to the crank shaft 12, the arms 103 of the governor being pivoted to the body of the governor 102 and carrying governor weights 104 at one end; their other ends normally lying within the channel 105, also formed on the movable member 97. A spring 106 is interposed between

the governor and the movable member, normally forcing said movable member away from said governor. Upon rotation of the crank shaft, the weights of the governor, under centrifugal force, will move the member 97 longitudinally of the shaft, toward the governor, and against the action of the spring 106. Near the extreme end of the crank shaft 12 a plate 107 is provided with a suitable opening to receive the crank shaft, but not in any way connected therewith, said plate being supported by an arm 108 preferably secured to the side frames 8 and to which said plate 107 is attached. A jaw 109 is pivoted to the plate 107 which cooperates with a jaw 110 pivotally mounted on the crank shaft 12 and backed up by a spring 111, one end of which is secured to the jaw 110 and its other end to the arm 108, said spring being backed by a washer 112 that is keyed to the crank shaft. A light spring 113, connected to the plate 107 at one end, bears against the jaw 109 normally forcing its jaw end outwardly. The arm 98 is of sufficient length to bring its stop end 99 between the jaws 109 and 110.

From the foregoing description it will be seen that when the engine is in operation the governor will cause the movable member to slide longitudinally of the crank shaft inwardly toward the governor and so hold the same, thereby separating the arm 98 from the jaws 109 and 110.

Assuming for the purposes of this description that an engine of the type shown may be considered to be in operation when fuel is being admitted to the cylinders of the engine and the ignition mechanism is also in operation for igniting the charge within the cylinders and the engine is not in operation when the ignition mechanism and fuel supply has been cut off, it will be apparent that immediately after the source of fuel supply and ignition mechanism has been cut off, the momentum of the fly wheel 14 will gradually decrease. The spring 106 will gradually overcome the force of the governor and the movable member 97 will thereby be forced longitudinally of the crank shaft toward its outer end; the arm 98 rotating around the plate 107 until its stop end 99 strikes the jaw 109, depressing its jaw end and engaging the jaw 110 which latter jaw will be moved on its axis against the action of the spring 111; the extent of its movement depending upon the force with which the arm 98 strikes the same. When the arm 98 is stopped by the jaw 110, the spring 111 then moves the arm 98 until it strikes the jaw 109, whereupon it is held between the two jaws. When the arm 98 is in the position shown in Fig. 3, one of the pistons in one of the cylinders is positioned in its

power stroke, the exact position of the piston having been pre-determined.

It is obvious that the jaws may be positioned upon the crank shaft to engage the arm 98 at any point in its rotating movement and consequently can be so adjusted as to engage the arm either at the beginning or near the end of the power stroke of the piston as may be desired. When the engine has been stopped and come to rest, it is obvious that it could not be again started with the jaws engaging the arm 98 and as a means for disengaging the movable arm member and the yieldingly fixed jaw members, a lever 114 is pivoted to a bracket 115 which may be secured to the side frame or to the bell crank 11, one end 116 of which extends within the channel 100 and a rod 117 is connected to its other end, said rod being connected at its top to a two part lever 118, the portion 119 of which is pivoted to the body 118 and is provided with a lug 120 adapted to engage a complementary lug on the body 118 to prevent pivotal movement in one direction. A stop block 121 is secured to the lever 93 for engaging the pivotal portion 119. When the lever 93 is in its forward position so as to bring the stop block 121 in its dotted position 122, movement of the lever to the left, as shown in Fig. 1, causes the stop block to engage the portion 119 of the lever, thereby lifting the rod 117 which in turn actuates the bell crank lever 114, causing the arm 116 to slide the movable member 97 toward the governor and thereby disengage the arm 98 and the jaws 109 and 110.

The operation of our device is substantially as follows: Assuming that the storage receptacle 37 contains suitable fuel, such as carbid, the liquid supply receptacle 61 contains water, the intake pipe 29 is connected with a carbureter of any well known type and that the engine is of the common construction complete for operation both as to fuel and ignition mechanism. When it is desired to start the engine and obtain an initial explosion, the lever 93 is first actuated to separate the arm 98 from the jaws 109 and 110 and this same movement of the lever 93 causes one of the valves 80 to be opened by means of one of the pins 95 engaging one of the timing plates 93, thereby bringing the valve opening 85 into its open position. By then actuating the lever 47 the conveying plate 40 is shifted from underneath the discharge opening 38, carrying its charge of fuel, which is deposited in the chamber 46; the top wall 32 having been lifted for permitting the conveying plate to rest upon the top surface of the receptacle 31. As soon as the fuel is deposited in the chamber 46 the conveying plate returns to its normal position with the opening 41 beneath the discharge opening 38

and the top wall 32 again rests upon the top surface of the receptacle 31. During this shifting operation and by the same movement of the lever 47, the piston 54 in the pump 53 is actuated drawing the liquid from the receptacle 61 and forcing such liquid into the chamber 46, whereupon acetylene gas is immediately generated, filling the communicating pipe 78 and flowing into the cylinder through the valve 80. The ignition mechanism is then operated exploding the charge of acetylene gas in the cylinder, whereupon the engine begins to draw its fuel from its main source of supply, namely, through the intake pipe 29. The intake valves 15 are then alternately opened for admitting the gaseous mixture in the intake pipe 29 into the cylinders and as the pressure of the acetylene gas in the pipe 78 is sufficient to open the valve 79, the fuel from the supply receptacle 31 will be drawn through the valve 79 into the intake pipe 29 and into the cylinders, in addition to the fuel supply from the carbureter, thereby doubly insuring the continuous operation of the engine. As it is contemplated that only a small charge of fuel will be placed within the receptacle 31, only sufficient gas will be generated for obtaining the initial explosion and aiding in the subsequent explosion of the gaseous mixture within the cylinders for a short period. When the engine is in operation the lever 47 is then pulled a little farther to the left as shown in Fig. 1, dumping the used fuel from the chamber 46; the lever being then again returned for its next shifting operation. When it is desired to stop the engine its fuel supply and ignition mechanism is cut off, the rotation of the fly wheel gradually diminishing in its momentum until the force of the spring 103 overcomes the force of the governor, whereupon the arm 98 strikes the jaw 110 and is held between said jaws as heretofore described.

It is, of course, obvious that we are not limited to the particular mechanism herein shown and described for accomplishing the objects which we desire to attain and that the broad principles of the mechanism herein described are applicable to explosive engines of one or more cylinders and that an auxiliary fuel, other than carbid, may be used, if so desired.

Therefore, without limiting ourselves to the particular details herein shown or described,

We claim:

1. The combination in an engine starter having a fuel supply receptacle and a communicating passageway with the cylinder of an explosive engine, of means for arresting the piston in said cylinder at a given point in the power stroke, comprising a movable

member connected with the crank shaft of said engine and slidably mounted thereon, a yieldingly supported stationary member, automatic means for throwing said movable and fixed members into engagement and manual means for throwing said members out of engagement.

2. The combination in an engine starter having a fuel supply receptacle and a communicating passageway with the cylinder of an explosive engine, of means for arresting the piston in said engine at a given point in its power stroke, comprising a movable member connected with the crank shaft of said engine, a yieldingly supported stationary member and means for simultaneously throwing said movable and stationary members out of engagement and for introducing a portion of the fuel in said receptacle into said cylinder.

3. The combination in an engine starter having a fuel supply receptacle and a communicating passageway with the cylinder of an explosive engine, of means for stopping the piston in said cylinder at a given point in its power stroke, comprising a movable member driven by said engine and a stationary member, spring means for normally causing said movable member to engage said stationary member, and a governor connected to said movable member for automatically holding said members out of engagement while said engine is in operation.

4. The combination in an engine starter having a fuel supply receptacle and a communicating passageway with the cylinder of an explosive engine, of means for arresting the piston in said cylinder at a given point in the power stroke, comprising a movable member connected with the crank shaft of said engine, a yieldingly supported stationary member, adapted to engage said movable member, means for introducing a charge into the fuel supply tank and for disengaging said movable and stationary members upon the movement of a single lever, automatic means for normally holding said movable member disengaged when said engine is in operation and spring means for throwing said movable and stationary members into engagement when the engine is not in operation.

5. The combination in an engine starter of a fuel supply receptacle, a fuel storage receptacle and a communicating passageway with the cylinder of an explosive engine from said fuel supply receptacle, of means for shifting a single fuel charge from said storage receptacle to said supply receptacle.

6. The combination in an engine starter of a fuel supply receptacle, a fuel storage receptacle, a liquid supply receptacle and a communicating passageway with the cylinder of an engine from said fuel supply receptacle, of means for shifting a single fuel

charge and a portion of liquid from said liquid supply receptacle to said fuel supply receptacle.

7. The combination in an engine starter
5 of an auxiliary fuel supply receptacle, and
an auxiliary communicating passageway
with the cylinder of an explosive engine, a
main communicating passageway communi-
cating with said cylinder independent of
10 said auxiliary passageway and an intermedi-
ate passageway between said auxiliary and
main passageways.

8. The combination in an engine starter
of an auxiliary fuel supply receptacle, and an

auxiliary communicating passageway with 15
the cylinder of an explosive engine, a main
communicating passageway communicating
with said cylinder independent of said aux-
iliary passageway, and a normally closed 20
valve in said intermediate passageway for
admitting fuel from said auxiliary fuel sup-
ply receptacle to said main communicating
passageway.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
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