W. S. EATON.

PRIMING CUP.

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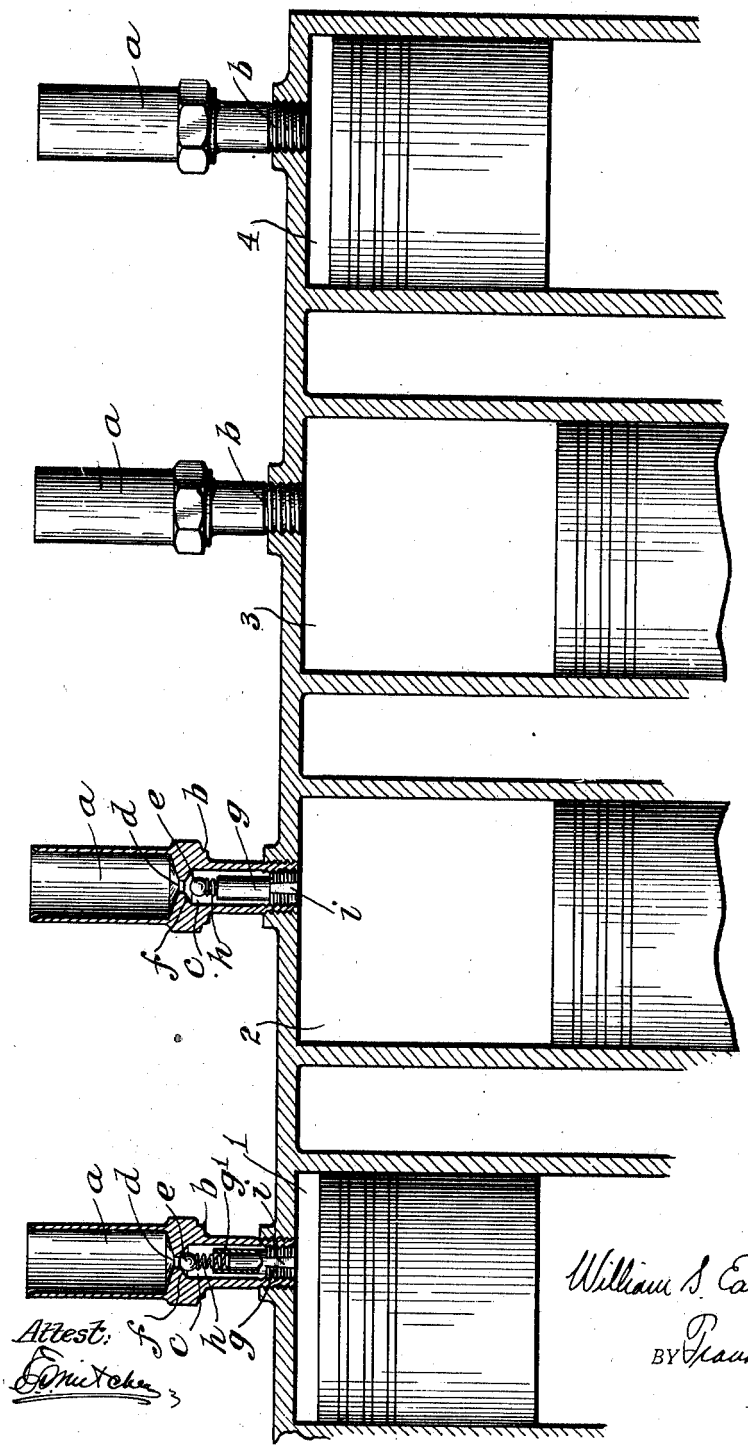
1,372,494.

Patented Mar. 22, 1921.



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PRIMING-CUP.

1,372,494. Specification of Letters Patent. Patented Mar. 22, 1921.

Application filed February 15, 1917. Serial No. 148,709.

To all whom it may concern:

Be it known that I, WILLIAM S. EATON, a citizen of the United States, residing at Sag Harbor, in the county of Suffolk, State of New York, have invented certain new and useful Improvements in Priming-Cups, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to priming cups, and more particularly to a device of this character adapted to be applied to each engine cylinder and to be actuated solely by the differential of pressure in cylinders during each cycle of operations of the engine.

A priming cup made in accordance with my invention is so constructed as to permit the introduction of a plurality of priming charges to each cylinder upon succeeding suction strokes of the piston therein, the port of communication between the priming cup and the cylinder being controlled by an automatically acting valve mechanism in a manner to prevent the blowing out of the reserve supply of gasolene, or other priming agent, during those piston strokes of a cycle during which the pressure in the cylinder will be above atmosphere. The priming cup of my invention is particularly adapted for internal combustion engines of the four cycle type, and it is possible with this priming cup, to fill the cups upon all the cylinders, at the same time, the introduction of the priming charge, upon cranking the engine, being limited to that cylinder in which the piston is moving outwardly, or making its intake stroke. The operation of a priming cup made in accordance with my invention being automatic throughout, it may be effectively used with mechanical starters and requires no attention beyond the hand filling of the several cups with gasolene, or other hydrocarbon, constituting the priming charge.

A priming cup made in accordance with my invention is so constructed and arranged that each priming charge will be drawn therefrom only when there is sub-atmospheric pressure within the cylinder, and that this charge will be so limited in volume as to prevent the delivery of an excess quantity of hydrocarbon from the priming cup. Furthermore, succeeding primings will be of substantially the same volume, and even though the charge in the cylinder may be fired at the first compression stroke of the piston therein, the priming cup on each of the cylinders will continue to be operative to enrich the mixture of succeeding charges, to facilitate the starting of the engine and its operation until it has developed the desired speed or power and has become sufficiently hot to insure the continued running of the engine. The further object of the invention is to provide a priming cup which in its functionings will have the operative effects above referred to, and which, in addition thereto, will have the added function, upon the exhaustion of the supply of the priming medium in the reservoir thereof, of admitting air in small volume directly to the cylinders of the engine upon each intake stroke of the piston thereof, in a manner to increase the efficiency of the explosive charge while the engine is running at higher speeds.

A priming cup made in accordance with my invention has the characteristics, that under no circumstances, can gases escape therethrough from the cylinder during the compression power or exhaust strokes of the piston.

The invention consists primarily in a priming cup embodying therein a reservoir having a top open to atmosphere and being of a capacity to receive hydrocarbon for a number of priming charges, a valve casing having a port therein communicating with said reservoir, a constricted off-take port leading therefrom adapted to discharge into an engine cylinder, said off-take port having relatively smaller capacity than said intake port, a valve seat adjacent said port leading to said reservoir, and a valve block mounted to move freely in said chamber, and coöperate with said valve seat and means adapted to normally seat said valve block whereby said duct will be open during the intake stroke of a piston in the cylinder to which the priming cup is applied, and will be closed during the remaining strokes of the piston; and in such other novel features of construction and combination of parts as are hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

In the accompanying drawings, I have shown, diagrammatically a four cycle type of internal combustion engine having applied to each cylinder thereof a priming cup made in accordance with my invention, the priming cups in two of the cylinders being

shown in vertical section with the valve mechanism in the open and in the closed positions respectively.

In the accompanying drawings, the cylinders of the engine are indicated by the numerals, 1, 2, 3 and 4, the pistons in cylinders 1 and 4 being shown at the limit of their in stroke and the piston of cylinders 2 and 3 being shown at the limit of their out stroke.

In the embodiment of my invention shown in the drawing, *a* indicates a reservoir adapted to receive a sufficient volume of gasolene, or other hydrocarbon, for a number of priming charges. This reservoir is open at the top and is mounted upon, or formed integrally with, a casing *b* having exterior screw threads by means of which the cup may be applied to an engine cylinder. The casing *b* has therein a valve chamber *c* having a port *d* communicating with the bottom of the reservoir *a* and an outlet port, or ports, discharging into an engine cylinder. Within the chamber *c* is a valve block *e* preferably a metal ball, mounted to move freely therein and adapted to coöperate with a valve seat *f* about the port *d* within the said chamber in a manner to normally prevent the flow of hydrocarbon from said cup. Carried by the lower end of the casing *b* is a plug *g* having an opening *g'* therein forming a cup for a spring *h* acting upon the valve block *e* in a manner to normally seat same to close the port *d*. The ports establishing communication between the chamber *c* and the engine cylinder are preferably formed by a plurality of channels *i* in the sides of the plug *g*, these channels being sufficiently small to permit only a limited quantity of hydrocarbon to flow therethrough during that interval coinciding with the intake stroke of the piston; while at the same time, causing this hydrocarbon to enter the cylinder in the form of spray.

The spring *h* is of sufficiently light tension to permit the unseating of the valve *e* under sub-atmospheric pressure developed in the cylinder upon the intake stroke of the piston while being sufficiently strong to seat said valve independently of the pressure developed by the compression or explosion of gases in the cylinder.

The cup *a* is provided with an exterior, hexagonal portion to facilitate its application or removal from a cylinder.

The operation of the herein described priming cup is substantially as follows:—

In describing the operation of the cup, it will be assumed that the engine is "dead" and that the pistons of cylinders 1 and 4 have been raised to the full extent of their in stroke, and that the pistons in cylinders 2 and 3 have been lowered to the full extent of their out stroke.

Before starting the engine, the reservoir *a* of each of the priming cups is filled with gasolene, or other hydrocarbon. When the reservoirs are so filled, the priming cups require no further attention since the valve *e* will prevent the escape of the hydrocarbon from any of these reservoirs into the cylinder to which the cup is applied, so long as the engine is at rest. The engine is then turned over, either by hand or by means of a mechanical starter. Ordinarily the pressure in cylinder 4 will be sufficiently great to prevent the outer movement of the piston therein developing sub-atmospheric pressure in said cylinder. As the piston of cylinder 1, however, moves outwardly it will draw in a charge of explosive mixture through the carbureter, and at the same time develop sub-atmospheric pressure in the cylinder, thus unseating the valve *e*, and drawing a priming charge from the reservoir *a* of the cup carried by said cylinder, through the port *d* and channels *i*; which hydrocarbon will be sprayed into the cylinder thus enriching the charge delivered through the intake port of the engine. Immediately upon the termination of the intake stroke of the piston in this cylinder, and during the initial compression stroke thereof, the pressure in the cylinder will be raised sufficiently to permit the spring *h* to seat the valve *e* and thus interrupt the flow of the hydrocarbon from the reservoir *a*, and at the same time, prevent the gases under compression in the cylinder, entering said reservoir and forcing any of the remaining hydrocarbon therefrom. Upon the ignition, or power, stroke of the piston in cylinder 1, the piston in cylinder 4, will draw in its charge of explosive mixture, and with it a priming charge from the priming cup applied to said cylinder 4; the cylinders 2 and 3 in succession drawing in a charge of explosive mixture through their intake ports and a priming charge through the priming cup applied to each.

The priming charge delivered to each cylinder consists of a portion only of the contents of the reservoir of the priming cup, and its delivery ceases immediately with a reversal in the direction of the movement of the piston, for the compression stroke thereof. In this manner, each of the cylinders in succession will receive a priming charge so that in the event any cylinder misses, the next cylinder will be primed. Hence the likelihood of igniting a charge in one of the cylinders is very much increased by means of the regular systematic introduction of priming charges to the cylinders in the succession of their intake strokes. Furthermore, since only a portion of the hydrocarbon is withdrawn from the reservoir *a* upon each intake stroke in the cylinder to which the priming cup is applied, in the event that all of the cylinders miss upon the first few revolutions of the engine, nevertheless, suc-

cessive explosive charges delivered to each cylinder will be similarly enriched so that when the charge in one of the cylinders is fired that cylinder will have been primed prior to such ignition. At the same time, the introduction in the form of a spray, of a small volume of hydrocarbon into the cylinder will prevent the accumulation of an excess of hydrocarbon in the cylinder, although danger from back firing in the muffler is not eliminated.

In the event that the charge in cylinder 1 is ignited upon the first compression stroke of the piston therein, the explosive charge upon a number of succeeding intake strokes of the piston, will be enriched by the introduction of hydrocarbon, from the priming cup applied to that cylinder, thus insuring a sufficiently rich mixture upon the starting of an engine, or until it has an opportunity to become slightly heated and to pick up speed.

During the compression, ignition and exhaust strokes of a piston, whether or not the explosive charge has been fired, the valve *e* will remain seated so that it is impossible for any of the gases within the cylinder to escape through the priming cup.

When the supply of hydrocarbon in the reservoir has been exhausted, the valve *e* will still be automatically actuated during each intake stroke of the piston, so that air in small volume will be admitted directly to the cylinder through the priming cup. It is generally recognized that the admission of a small volume of air to the cylinder tends to add to the engine efficiency, and to economy in its operation, particularly at the higher speeds; provided that the volume of air introduced is not sufficient to dilute the explosive charge to an extent which will impair its efficiency. The ports in a priming cup made in accordance with my invention, are sufficiently small to prevent the admission of an excessive volume of air, or of a volume of hydrocarbon in excess of that required for an effective priming charge.

It is not my intention to limit the invention to the details of construction shown in the drawings, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new, and desire to have protected by Letters Patent is:—

1. A priming cup embodying therein a reservoir having a top open to atmosphere and being of a capacity to receive hydrocarbon for a number of priming charges, a valve casing having an intake port therein communicating with said reservoir, a valve seat about said port and a constricted off-take port leading therefrom and adapted to communicate with an engine cylinder, said off-take port having relatively smaller capacity than said intake port, a valve block mounted to move freely in said casing and coöperate with said valve seat and means adapted to normally seat said valve block whereby said duct will be opened during the intake stroke of the piston in the cylinder to which the priming cup is applied and will be closed during the remaining stroke of the piston.

2. A priming cup embodying therein a reservoir having a top open to atmosphere and being of a capacity to receive hydrocarbon for a number of priming charges, a valve casing having an intake port therein communicating with said reservoir, a valve seat about said port and a constricted off-take port leading therefrom and adapted to communicate with an engine cylinder, said off-take port having relatively smaller capacity than said intake port whereby the priming fluid delivered from said reservoir to the cylinder will be sprayed into the cylinder, a valve block mounted to move freely in said casing and coöperate with said valve seat and a spring having a light tension adapted to normally seat said block whereby said duct will be opened during the intake stroke of the piston in the cylinder to which the priming cup is applied and will be closed during the remaining stroke of the piston.

3. A priming cup embodying therein a casing adapted to be connected with an engine cylinder, a reservoir having a top open to atmosphere and being of a capacity to receive hydrocarbon for a number of priming charges surmounting said casing, and said casing having therein a valve chamber, an intake port leading therefrom into the bottom of said reservoir, and a valve seat about said port, a cup shaped screw plug mounted in the bottom of said casing, said plug having a shallow channel on the side thereof of relatively smaller capacity than said intake port, a valve seated in said valve chamber adapted to coöperate with said valve seat and a spring having a light tension acting upon said valve whereby the flow of priming fluid from the said reservoir will be prevented at all times excepting when the pressure in an engine cylinder is sub-atmospheric.

In witness whereof I have hereunto affixed my signature in the presence of two subscribing witnesses this 31st day of January, 1917.

WILLIAM S. EATON.

Witnesses:
CLARICE FRANCK,
BERTHA MUELLER.