

UNITED STATES PATENT OFFICE.

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MOTOR.

945,001.

Specification of Letters Patent. **Patented Dec. 28, 1909.**

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To all whom it may concern:

Be it known that I, EMMETT H. HERNDON, a citizen of the United States, residing at Sanford, in the county of Orange and State of Florida, have invented a new and useful Motor, of which the following is a specification.

This invention relates to a novel form of motor or engine of the type wherein the ignition of an explosive mixture creates a pressure to propel the moving parts of the engine.

An object of the invention is to provide an engine in which provision is made for ready conversion into either two cycle or four cycle type.

With this and other objects in view, as will more fully hereinafter appear, the invention consists in certain novel features of construction and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings:—Figure 1 is a side elevation of a motor provided with an internal combustion engine constructed in accordance with the invention. Fig. 2 is a transverse view of the motor on the line 2—2 of Fig. 1. Fig. 3 is a diagram showing the operation of the main and auxiliary pistons.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The present application is a division of an application for Letters Patent on which Letters Patent No. 896,448 were granted to me on August 18, 1908, for a motor.

The motor which forms the subject of the foregoing patent is one in which three pairs of alining cylinders are arranged at equidistant intervals around a main shaft. The two pistons belonging to each pair of cylinders are rigidly connected and each pair carries a pin or projection which enters a helical return groove formed in the shaft or

a drum that is rigidly secured to the same. As the pistons are reciprocated, the pins or projections traverse this helical groove and cause the shaft to rotate. The shaft controls the timing devices, and further operates to return the scavenging pistons of the cylinders as hereinafter described.

The general frame of the engine includes boxes 10, rigidly secured together by a tubular shell 11, and each box is provided with semi-circular depressions 16, for the reception of the three sets of cylinders 17, the cylinders being confined in place by straps 18. The boxes 10 are hollow and constitute exhaust chambers which are in free communication with the cylinders through ports 20, the latter being arranged to open when the piston reaches the limit of the working stroke, and these boxes communicate with a muffler 21 having a discharge pipe 22 through which the products of combustion from all of the cylinders finally escape. Secured rigidly to the shaft at a point between the two boxes is a drum 27 that is provided with a return helical groove 28 of such pitch that there will not be undue friction between the walls of the groove and the piston actuated members which enter such groove.

The cylinders are arranged in pairs, those constituting each pair being arranged with their axes in alinement and within each pair of cylinders fits a double ended piston 29. Projecting from the central portion of each piston is a stud 30 carrying two anti-friction rollers 31 and 32, all of the rollers 32 entering the helical groove of the drum 27, while all of the rollers 31 are arranged for contact with the walls of the slots 33 that are formed in the cylindrical shell 11. These slots 33 extend longitudinally of the shell and are parallel with the axes of the shaft and cylinders, so that they serve to maintain the studs 30 in proper position and prevent any turning of the pistons on their axes, so that the pistons proper are not subjected to any torsional strain from the engagement of the rollers 32 with the walls of the helical slot 28. Each of the pistons 29 is preferably in the form of a hollow cylinder closed at both ends and preferably of uniform diameter throughout its entire length, although it may

be in the form of a pair of piston heads connected by a stem of less diameter than the heads.

Each of the cylinders is of precisely the same construction as the others, the explosion chamber having a cap or cover 38 from which extends a tube 39, the axis of which is coincident with that of the cylinder. Through this tube passes a rod 40 carrying at its inner end an auxiliary piston 41 in which are formed one or more transverse ports 42. These ports are provided with valves 43 that are normally held in closed position by springs 44 coiled around the valve stems and bearing at one end against the piston and at the opposite end against adjustable nuts carried by the stems. The outer end of the rod 40 carries a hook 45 to which the outer end of a tension spring 46 may be attached, the inner end of the spring being connected to an eye on the head of the explosion chamber, the hook projecting through an elongated slot 47 formed in the wall of the tube 39, and said spring tending at all times to force the auxiliary piston 41 away from the head of the explosion chamber.

Projecting from the stem 40 is an anti-friction roller 48 that is mounted on a stem 49 passing through a slot 50 formed in tube 39. This roller is arranged to be engaged by a cam 51 on the shaft, the shaft being provided with two cams one for each set of operating cylinders at each end of the motor.

At the explosion chamber head is an inlet 53 leading from the carbureter or other source of supply and through which the explosive mixture is admitted to the cylinder. Arranged slightly in advance of each auxiliary piston is a sparkler 54 of any ordinary construction, provision being made for controlling the igniting circuits in order to advance or retard the spark, as desired.

In the operation of the motor as a two cycle engine, reference is had to the cylinder shown in Fig. 1, wherein the piston 29 is traveling toward the right and has nearly reached the end of the working stroke, it being observed that the escape port 20 of the left hand cylinder is nearly full open. During this working stroke the pressure of gases within the cylinder has kept the auxiliary piston stationary, although the roller 48 of the latter is at this time out of engagement with its operating cam 51. As soon, however, as the port 20 opens to such an extent as to permit the partial discharge of the products of combustion the pressure in the cylinder will reduce to a point below the stress exerted by the spring 46, which at this time has been placed under tension. When the pressure reduces to a point below the strength of the spring, the latter in retracting will force the auxiliary piston inward toward the exhaust port, thereby forcing out the remainder of the exploded charge, and,

at the same time, creating a partial vacuum at the explosion chamber end of the cylinder, thereby causing an inflow of an explosive charge, and during this movement the valves 43 will remain closed in order to prevent the admixture of the fresh charge with the exploded gases.

As the anti-friction roller of the piston makes the turn in the helical groove 28, the roller 48 of the auxiliary piston will be engaged by the cam 51 and the auxiliary piston will be moved outward by the cam in advance of the piston 29, as will be evident on reference to the diagram, Fig. 3, where the inclination of the cam is shown to be much quicker than the inclination of the groove, so that the auxiliary piston will arrive at the end of its out stroke or the stroke toward the explosion chamber head long before the main piston completes its stroke in the same direction. During this out stroke of the auxiliary piston the valves 43 open and the fresh charge passes to the space between the two pistons and is compressed therebetween as the main piston completes its stroke, and at the end of this stroke the fresh charge of compressed explosive mixture is ignited by the spark plug and another working stroke is effected.

When the engine is to be operated on the four cycle principle, the spring 46 is detached from the hook 45 and the rod 40 is locked to the tube 39 so as to prevent movement of the auxiliary piston 42, the rod 40 being provided with an opening 79 into which a suitable pin may be inserted for this purpose. The device will then operate as an ordinary four cycle engine with the exception that the exhaust port will be under the control of the main piston and will be opened by the piston when the latter reaches the limit of the working stroke.

I claim:—

1. In an internal combustion engine, a cylinder having an inlet port at the explosion chamber end and a piston controlled exhaust port at the opposite end, a main piston within the cylinder, and another piston in the cylinder at the explosion chamber end thereof and provided with a valved port opening toward the main piston, means for moving the second named piston to expel the burned gases and to draw in a fresh charge at the completion of the working stroke, and means for locking the second named piston in the retracted position to convert the engine into a four cycle engine.

2. In an internal combustion engine, a cylinder having an intake port at the explosion chamber end and a piston controlled exhaust port near the opposite end, a main piston working in said cylinder, an auxiliary piston having valved ports extending there-through, an operating rod extending from the auxiliary piston, a spring connected to

the rod and tending to force the auxiliary piston in the direction of the exhaust port, means for moving the auxiliary piston in the opposite direction, and means for locking
5 said auxiliary piston from movement when the engine is to operate as a four cycle engine.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

EMMETT H. HERNDON.

Witnesses:

F. T. FOSTER,

B. F. WHITNER, Jr.