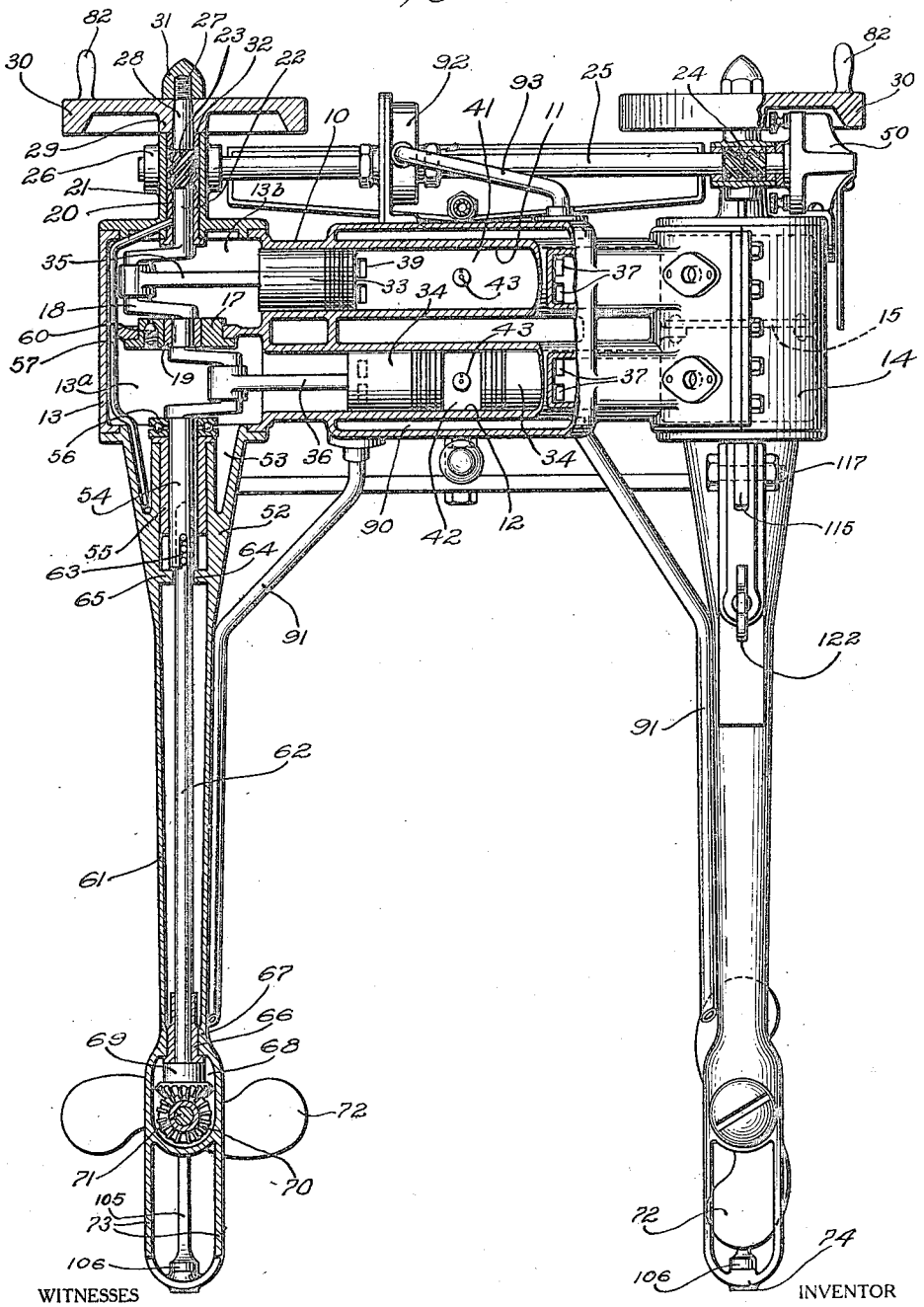
April 2, 1929. G. BIZET 1,707,897

OUTBOARD MOTOR

Filed Dec. 23, 1925 3 Sheets-Sheet 1

Fig. 1.



WITNESSES

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Fig. 2.

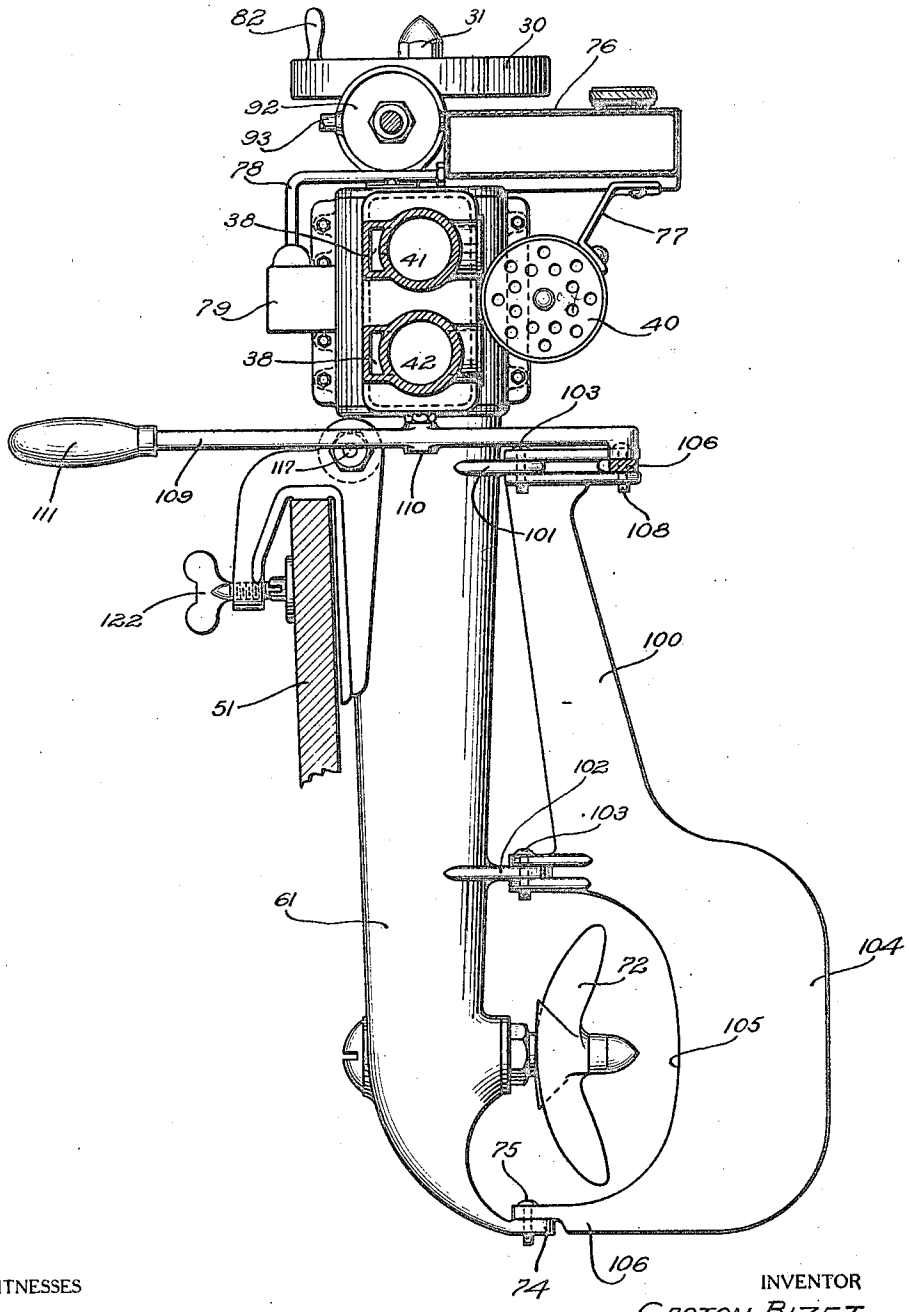

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Fig. 3.

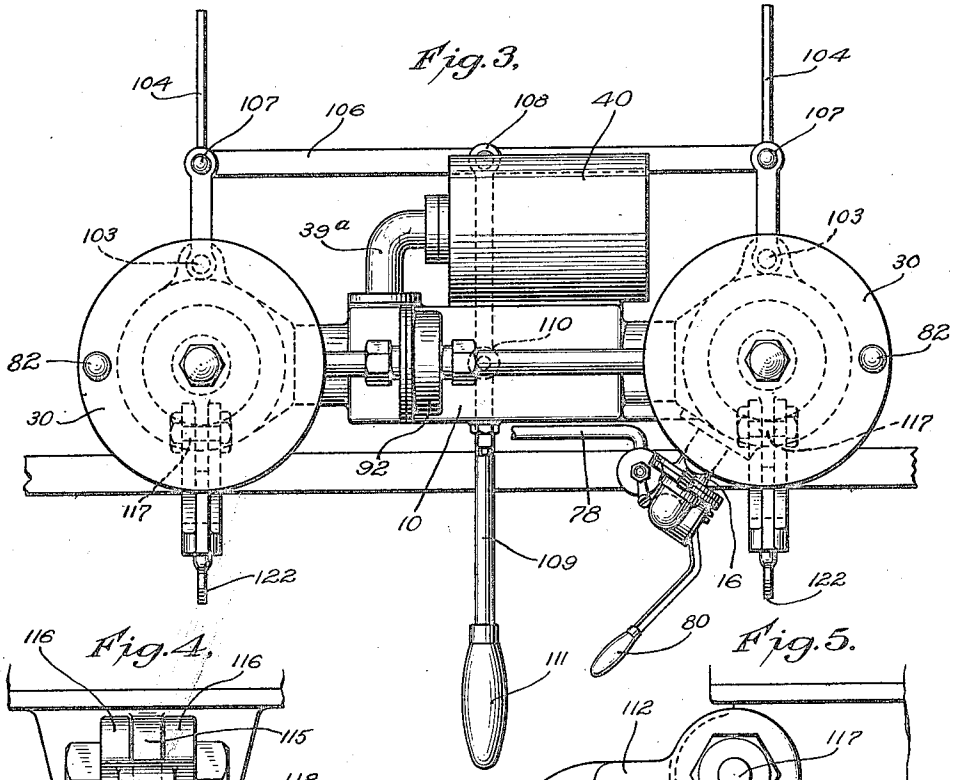


Fig. 4.

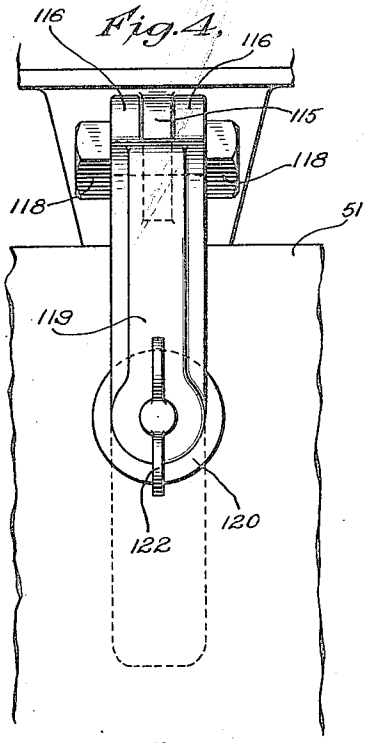
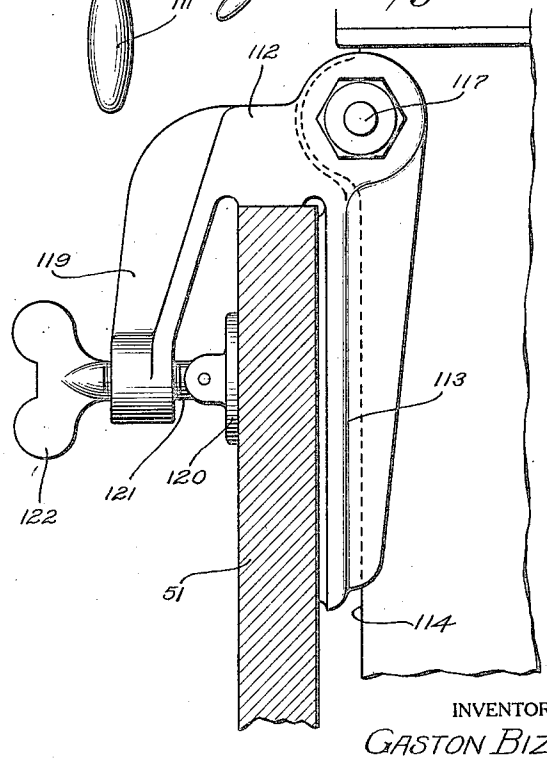


Fig. 5.



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UNITED STATES PATENT OFFICE.

GASTON BIZET, OF NEW YORK, N. Y.

OUTBOARD MOTOR.

Application filed December 23, 1925. Serial No. 77,283.

An object of the present invention is to provide a twin screw outboard motor.

A further object of the invention is to provide a motor of this character in which the two propellers are synchronized, and a motor with which I obtain a material increase in power with but a slight increase in the weight of the device.

Another object of the invention is to provide a motor of this class embodying the two cylinder two cycle balanced stroke engine in which two driven pistons in each cylinder drive power shafts at opposite ends of the cylinders. These power shafts are used for driving the propellers, and by virtue of the balanced stroke of the engine, I am enabled to drive the two screws with materially less vibration than is commonly found in either vertical or horizontal engines at present in use for operating a single screw.

A more specific object of the invention is to provide novel means for supporting the motor on the stern of a small boat, either in operative driving position, or in canted inoperative position.

Another specific object of the invention is the provision of an improved oiling system for properly lubricating the crank shaft and associated mechanism at the dead end of the engine.

Still another object of the invention is to provide a unique and efficient water circulating cooling system through which water is preferably circulated by a pump on the synchronizing shaft.

Other novel features are the provision of two fly wheels manually operable for selectively starting the engine either ahead or in reverse, novel means for mounting and protecting the propellers, and novel means for mounting and controlling the rudders.

With the above noted and other objects in view, the invention consists in certain novel features of construction and combinations and arrangements of parts, as will be more fully hereinafter set forth and pointed out in the claims. The invention may be more fully understood from the following description in connection with the accompanying drawings, wherein

Fig. 1 is a view mainly in longitudinal section and partly in elevation showing a between screw outboard motor embodying the invention.

Fig. 2 is a vertical sectional view therethrough.

Fig. 3 is a top plan view of the engine with the fuel tank removed.

Fig. 4 is a fragmentary front elevational view of one of the brackets for securing the motor to the stern of a boat.

Fig. 5 is an enlarged side elevational detail of the bracket.

In the drawings I have used the reference character 10 to designate an engine block formed with cylinders 11, 12 which open at their ends into crank cases 13, 14. The crank case 14 is divided transversely by partition indicated in dotted lines at 15, and to the crank case 14 I attach the intake manifold (not shown). A generally similar partition member 17 is mounted in the other crank case 13 at the dead end of the engine, dividing this crank case into a pair of crank case compartments 13^a, 13^b. The crank shafts 18 have suitable bearings 20 in extensions 21 projecting upwardly from the crank cases. Vertical crank shaft extensions 22 carry screws 23 meshing with worms 24 on a transverse synchronizing shaft 25, said shaft having suitable bearings 26 preferably formed as integral castings with the crank case extensions 21.

The upper end of each crank shaft extension 22 is preferably threaded as at 27 and tapered as at 28. The hubs 29 of fly wheels 30 fit the tapered portions 28 of the crank shaft extensions and are retained in place by securing nuts 31. The numerals 32 have been used to indicate the splines which key the fly wheels to the crank shafts.

Within each horizontal cylinder 11 I mount a pair of pistons, one pair being designated at 33, and the other pair at 34. Connecting rods 35 and 36 couple the respective pairs of pistons to the crank shafts 18. The intake ports 37 for the cylinders 11, 12 communicate with longitudinally extending intake passages 38 opening into the crank case 14. Near the opposite ends of the cylinders I provide exhaust ports 39 communicating with an exhaust muffler 40, through an exhaust manifold 39^a. The portions of the cylinders between the two pistons define the combustion chambers 41, 42, and approximately at the center of this space I mount the firing pins or spark plugs 43.

The parts are so proportioned that the pis-

tons open both inlet and exhaust ports at the end of the firing stroke, the engine operating on the two cycle principle and utilizing the incoming fuel to scavenge the vitiated gases and products of combustion.

In the position shown in Fig. 1, cylinder 12 is just ready for firing, and cylinder 11 is receiving incoming fuel. When the cylinder 12 fires, its pistons 34 will be driven toward opposite ends of the cylinder, the right hand piston 34 compressing the fuel in crank case 14, and when this piston clears the inlet port 37, the fuel under compression in the crank case will rush into cylinder 12 through the passage 38 and inlet ports 37 of this cylinder. As the ports 37 are opened, the exhaust ports 39 are simultaneously uncovered so that the incoming gases drive the vitiated gases and other products of combustion to exhaust through the ports 39.

While this operation has been taking place in the cylinder 12, the pistons 33 of the cylinder 11 will have been advancing toward each other under the power impulse of the pistons 34. The relative advance of the pistons 33 acts to compress the fuel at the center of the cylinder prior to firing.

It will be noted that this type of engine in which oppositely acting pistons are provided in each cylinder, and in which the firing strokes of one set of pistons are balanced by the compression strokes of the other set of pistons, practically eliminates vibration. The direct coupling of the crank shafts 18 by the synchronizing shaft 25, insures movement of all of the pistons through similar distances, and causes the crank shafts 18 to rotate at exactly the same speed.

The ignition mechanism of the engine may be entirely conventional, including the usual type of Ford timer 50 mounted on the crank case 14 and operated from the synchronizing shaft 25. The timer is connected to ignition coils which are not illustrated, and which may be conveniently mounted in the bottom of the boat 51, together with the battery (not shown) which supplies energy to the ignition system.

The crank case 14 and the crank shaft 18 mounted therein are thoroughly lubricated by the incoming fuel which is generally a rather heavy mixture of gasolene and kerosene, although heavier oils might be used in some instances. This fuel however, never reaches the crank case 13 at the dead end of the engine, and it is consequently necessary to provide a separate lubricating system for this crank shaft 18, and its associated parts. It will be noted that each crank case is closed at the bottom by a casting 52, this casting being generally tubular and defining an annular well 53 at its upper end which communicates with the crank case. The lower ends of the crank shafts are formed with driving extensions 54 having bearings in bushings 55 fitted into the upper ends of the tubular castings 52, said bushings preferably mounting roller bearings 56, or other anti-friction devices which support the weight of the crank shafts.

The crank case 13 is preferably partially filled with lubricating oil which will flow gravitationally into the trough or well 53 at the lower end of the crank case. Dipping into this well is one end of an oil circulating pipe 57 which passes through the partition 17, and delivers oil through bearing sleeve 20 to the crank shaft extension 22. As the left end piston 34 moves toward the end of its firing stroke it will exert pressure on the oil in the crank case 13, forcing this oil upwardly through the pipe 57 and around the crank shaft extension 22 into the upper crank case compartment 13^b. In this connection it is to be noted that the pipe 57 is of relatively large cross section, so that oil will be delivered in the relatively small space around the crank shaft extension 22 under considerable pressure.

As the left end piston 33 moves toward the end of its firing stroke, compressing the oil in chamber 13^b, this oil will be forced back to the chamber 13^a, around a spring pressed ball check 60 mounted in the partition 17. There is no possibility of forcing the oil backwardly through the pipe 57 because the ball check 60 presents materially less resistance to the passage of oil from the chamber 13^b, than does the restricted upper end of pipe 57.

The castings 52 include elongated depending tubular extensions 61 which house vertically disposed propeller shafts 62 coupled as by the slot and pin connection 63 to the crank shaft extensions 54. Shafts 62 may conveniently have bearings at 64 in internal flanges 65 near the upper ends of castings 52. Bearing bushings 66 fitted into reduced portions 67 near the lower ends of the casting extensions 61, provide bearings for the lower ends of the propeller shafts 62. Immediately below the bearings 66, the castings 52 define gear cases 68 which house bevelled driving gears 69 at the lower ends of shafts 62, and bevelled driven gears 70 fixed to short horizontally disposed propeller shafts 71. Propeller shafts 71 are journalled in the walls of the gear cases 68 and carry propellers 72 which may be of conventional construction.

Below the gear cases 68, the castings 52 are of skeleton construction, including a plurality of depending arms 73 integrally united at their lower ends and providing a rearwardly extending apertured lug 74 for the reception of the lower pivot bolt 75 for the rudders which will be more fully hereinafter described.

From the foregoing description it will be apparent that the balanced stroke two cycle,

two cylinder engine will drive the propellers at equal speeds at all speeds of the engine. The engine construction, except as above specifically pointed out, may be more or less conventional. The fuel tank 76 may be mounted in any convenient position as upon brackets 77 carried by the muffler 40. The liquid fuel supply pipe 78 from the tank 76 delivers to a conventional carburetor 79 which may be manually controlled by an air throttle lever 80 in any convenient manner. The timer is manually adjusted before starting the engine, and subsequently manually adjusted for any suitable running speed. Handles 82 on the fly wheels 30 permit these wheels to be manually spun in starting, and it will be readily apparent that the engine may be selectively started either ahead or in reverse by spinning one or the other of the fly wheels after the timer has been set and the fuel supply line opened.

A feature of the invention is the novel cooling system which I use for cooling the engine. As best seen in Fig. 1, the engine is suitably water jacketed at 90, and the water jacket is connected to two pipe lines 91, which two pipe lines are led down along the tubular castings 61 and terminate below the water line at about the level of the propellers. The circulating pump 92 for the cooling system, may drive a gear pump of conventional construction, and is formed with a pair of pipe leads 93 which communicate with the water jacket 90. The direction of circulation of cooling liquid through the water jacket depends upon whether the engine is moving ahead or in reverse. The gear pump 92 is double acting, and the pipes 91 may serve either as intake or outlet pipes for the cooling water depending upon the direction in which the engine is running. Thus, every time the direction of rotation of the engine is reversed, the direction of water flow through the jacket is reversed.

The steering means includes a pair of rudders, the shanks 100 of which are pivotally connected at their upper and lower ends to brackets or lugs 101, 102 projecting rearwardly from the member 61. The blades 104 of the rudders are cut away as at 105 at their forward edges to accommodate the propellers and include extensions 106 at their lower ends pivoted to lugs 74 by the pivot bolts 75. Connecting the rudders is a transverse bar 106 pivoted as at 107 to the upper end of each shank 100. This bar at its intermediate portion is pivotally connected as by pin 108 to the rear end of a tiller 109, the intermediate portion of which is pivotally secured beneath the engine block as at 110. A suitable handle 111 carried by the forward end of the tiller, is preferably arranged closely adjacent to the throttle lever so that an operator may conveniently handle both the throttle and the tiller at the same time.

The motor is preferably mounted on the stern of a small boat in such a manner that it may be canted forwardly to lift the propellers out of the water when the motor is not in use. With this end in view, I employ a pair of U-brackets 112, adapted to be clamped to the stern end of the boat. One arm 113 of the bracket lies flatly against the rear face of the stern and is of chanelled construction, receiving a web 114 at the forward edge of member 61. Web 114 is formed with an ear 115 received between ears 116, at the upper end of bracket arm 113, and pivot bolts 117 are passed through aligned apertures in the ears. On the ends of the pivot bolts are nuts 118 which may be selectively tightened to predetermine the frictional engagement between the ears 116 and 114 or between washers interposed between such ears. The forward arm 119 of each bracket carries a clamping plate 120 operated by clamping screw 121 formed with a thumb or handle nut 122 so that the brackets may be firmly clamped to the boat. The frictional engagement between the brackets and the motor at the pivot 117 is such that the engine may be canted forwardly to lift the propellers out of the water, and will be frictionally retained in canted position.

It is believed that the operation of the motor will be thoroughly understood from the foregoing description. It is to be noted that the device is subject to a wide variety of structural modifications, and that while I have illustrated a preferred embodiment of the invention, numerous changes and alterations might be made in the general form and arrangement of parts described without departing from the invention. Hence I do not wish to limit myself to the details set forth, but shall consider myself at liberty to make such changes and alterations as fairly fall within the spirit and scope of the appended claims.

I claim:

1. A horizontal two cylinder, two cycle balanced stroke engine comprising crank cases at the ends of the cylinders and communicating with the said cylinders, intake and exhaust ports near opposite ends of each cylinder, the intake being at one end only of each cylinder and the intakes of the cylinders being at the same end, crank shafts in the crank cases, means dividing the crank cases into separate compartments communicating with the separate cylinders, two pistons in each cylinder connected to the respective crank shafts and controlling respectively the inlet and exhaust ports, means for feeding fuel into one crank case only, and inlet passages extending parallel to the cylinders and connecting the inlet ports with the crank case into which the fuel is fed.

2. A horizontal two cylinder, two cycle balanced stroke engine comprising crank

cases at the ends of the cylinders and communicating with the said cylinders, intake and exhaust ports near opposite ends of each cylinder, the intake being at one end only of each cylinder and the intakes of the cylinders being at the same end, crank shafts in the crank cases, means dividing the crank cases into separate compartments communicating with the separate cylinders, two pistons in each cylinder connected to the respective crank shafts and controlling respectively the inlet and exhaust ports, means for feeding fuel into one crank case only, and inlet passages extending parallel to the cylinders and connecting the inlet ports with the crank case into which the fuel is fed, and means for synchronizing the crank shafts, including crank shaft extensions carrying fly wheels and a synchronizing shaft geared to the crank shaft extensions.

3. In an internal combustion engine, two cylinders open at each end, each cylinder having an intake port adjacent one end and an exhaust port adjacent its other end, a crank case at the ends of the cylinders, means for feeding fuel into one crank case only, a longitudinal passage at the sides of each cylinder and leading from the intake port into the crank case into which the fuel is fed, a crank shaft in each crank case and each having an extension at one end, a fly wheel on each extension and provided with a handle, a pair of pistons in each cylinder and rods connecting the pistons with the crank shafts, and a transverse synchronizing shaft geared to the extensions of the crank shafts.

4. An internal combustion engine, comprising two open ended cylinders, each having an intake only adjacent one end and an exhaust only adjacent its other end, the intakes and exhausts of the cylinders being at the same ends of said cylinders, a pair of pistons in each cylinder, crank cases at the ends of the cylinders and provided with partitions forming compartments therein, a crank shaft mounted in each crank case, rods connecting the cranks of the shaft with the pistons, means for feeding fuel into the compartments of the crank case at the ends of the cylinders having the intakes, the fuel serving to lubricate the crank shaft in the crank case, longitudinal passages leading from the intakes of the cylinders into the crank case into which the fuel is fed, means for feeding a lubricant from one compartment of the other crank case into the other compartment of said crank case, and means for synchronizing the crank shafts.

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