Jan. 21, 1936. W. O. BECHMAN 2,028,310

ENGINE

Filed Nov. 10, 1934 4 Sheets-Sheet 1

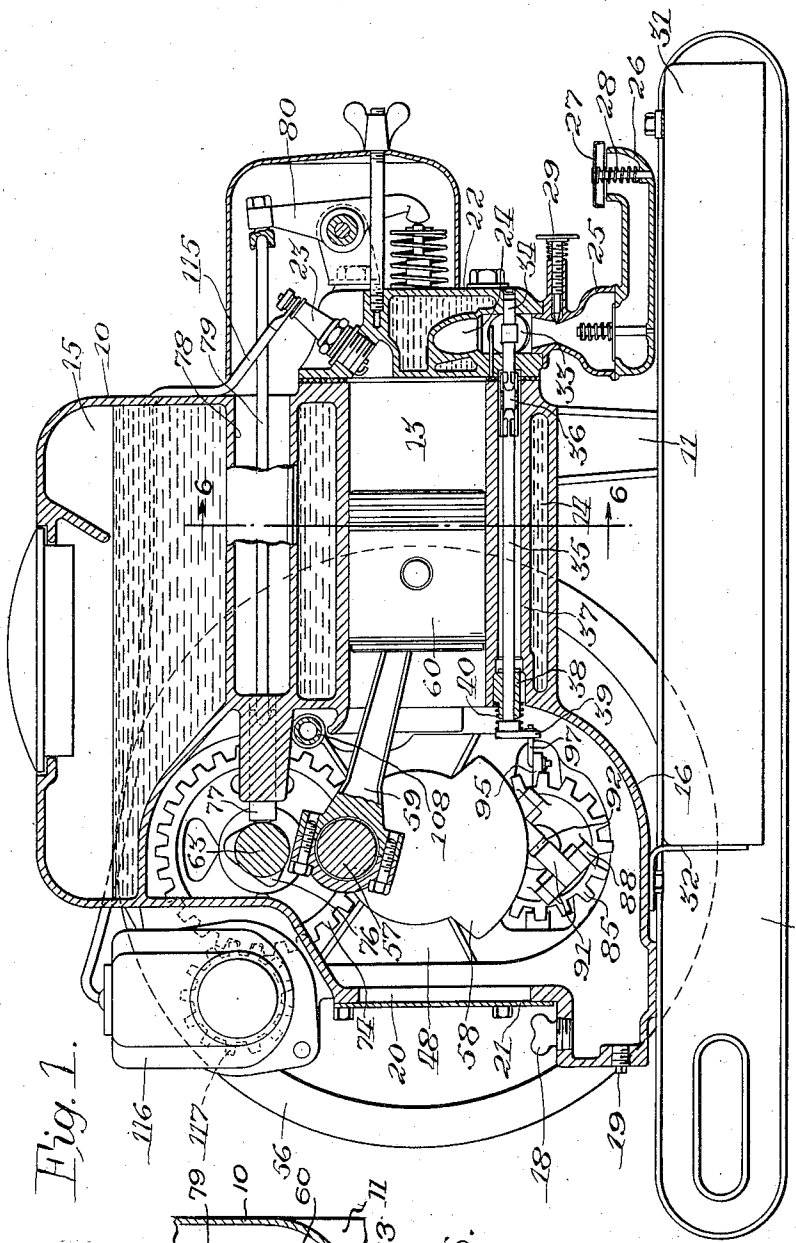


Fig. 1.

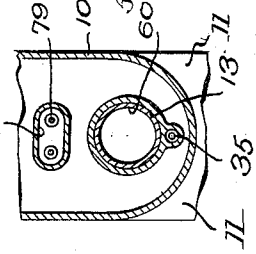


Fig. 6.

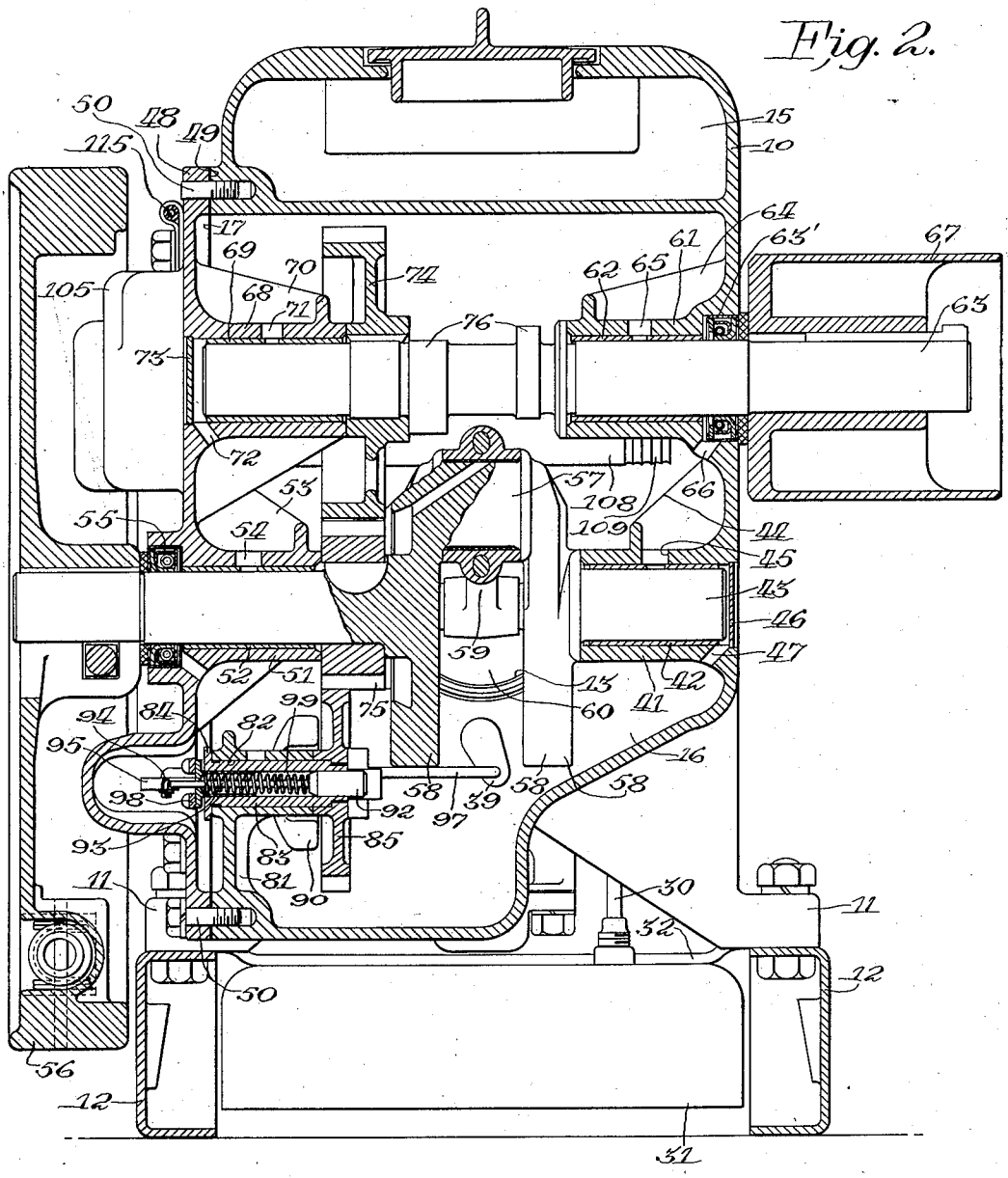
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Fig. 2.



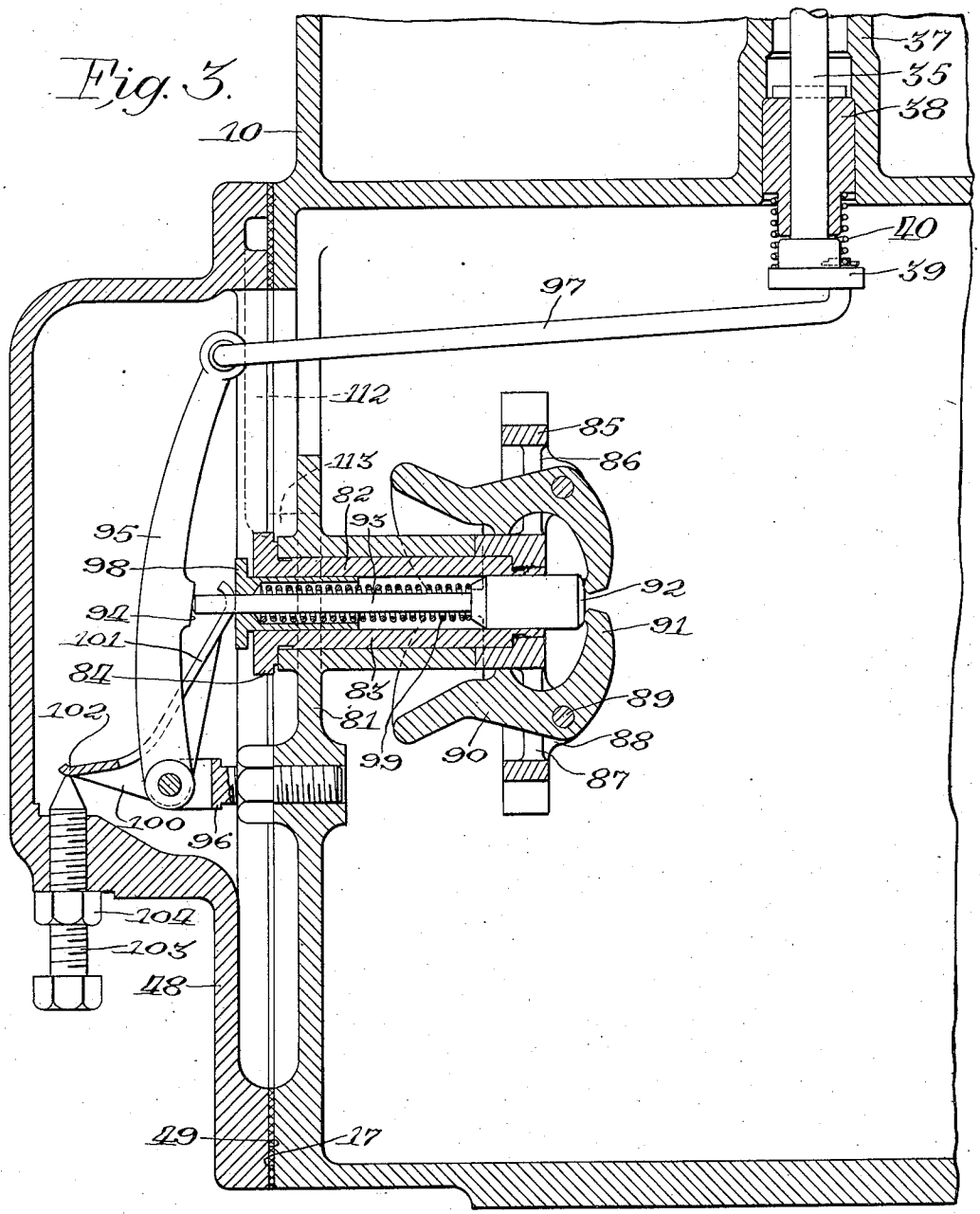
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ENGINE

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Fig. 3.



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Fig. 4.

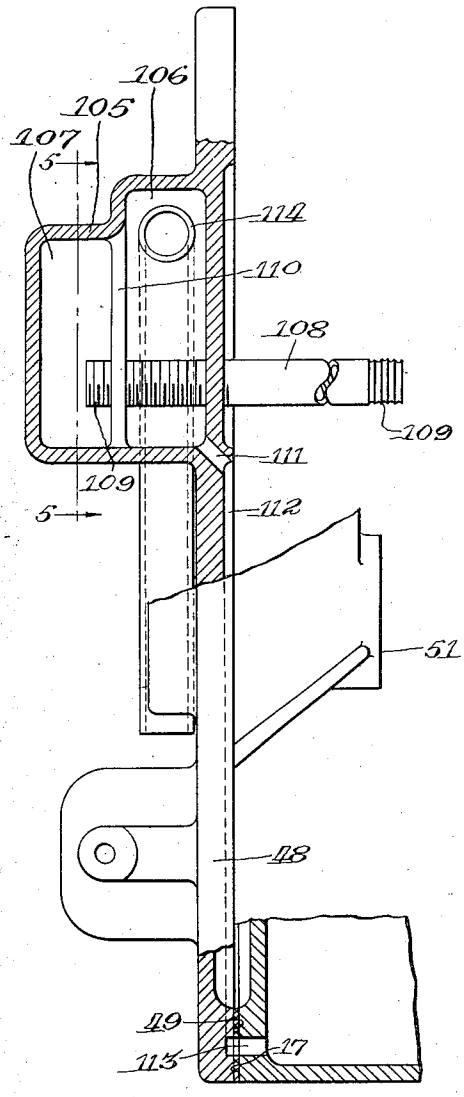
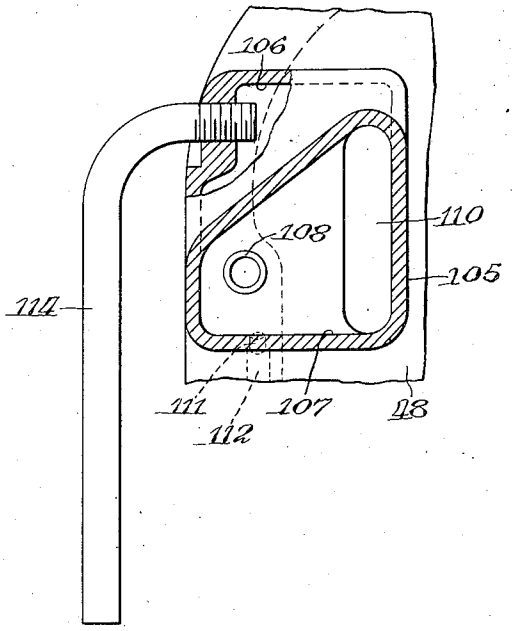


Fig. 5.



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UNITED STATES PATENT OFFICE

2,028,310

ENGINE

William Otto Bechman, Chicago, Ill., assignor to International Harvester Company, a corporation of New Jersey

Application November 10, 1934, Serial No. 752,419

9 Claims. (Cl. 123—195)

This invention relates to improvements in internal combustion engines. More specifically it relates to details of construction and to a governing arrangement as incorporated in a small single cylinder engine of the four cycle type.

The principal object of the invention is to provide a simplified, compact, and neat design of engine particularly adapted for the construction of small sizes generally having only one cylinder. A more specific object is to construct as a unit assembly substantially all of the fixed, stationary parts of the engine, and to provide in such a construction means for readily removing the moving parts of the mechanism. Another specific object is to provide a simplified governor particularly adapted to the improved, over-all construction effective to regulate the speed of the engine. Another specific object is the provision of a breather particularly designed to reduce the discharge of oil vapor to a minimum.

The above defined objects and others, which will be apparent from the description to follow, are attained by a construction such as illustrated in the drawings, in which:

Figure 1 is a vertical, longitudinal cross section of an engine embodying the invention;

Figure 2 is a transverse vertical section taken through the crank shaft of the engine shown in Figure 1;

Figure 3 is an enlarged, horizontal section taken through the governor shaft, showing the governor and the associated mechanism;

Figure 4 is a vertical, transverse section through the breather compartment, showing the arrangement of the breather pipes and the oil drain provided from the breather compartment to the crank case of the engine;

Figure 5 is a section taken on the line 5—5 of Figure 4; and,

Figure 6 is a cross section on a small scale on the line 6—6 of Figure 1.

The engine as illustrated in the drawings is of a unit type well known in the industry, and operates on the four-cycle principle, with spark plug ignition supplied by a magneto driven by the engine. The Bechman Patent 1,915,283, dated June 27, 1933, shows a similar engine and all of the details of construction including the mechanism for operating the inlet and exhaust valves. Such details have not been completely shown in the accompanying drawings, as they are well known in the art and as this invention includes only such parts of an engine as are necessary to cooperate with the parts defined in the claims as being novel.

The engine block and the associated parts, cast as an integral unit, are designated generally by the numeral 10. Said block is provided with suitable apertured brackets 11 secured to spaced runners 12, which form means for supporting and transporting the engine. The block 10 includes a horizontal cylinder 13 surrounded by a spaced wall forming a water jacket 14, to which cooling water is supplied from a hopper 15. The block also includes a crank case 16, which is formed to house the moving parts of the engine. Said crank case is open at one side, a flat face 17 in a plane perpendicular to the axis of the crank shaft being formed around the opening. The crank case 16 forms the oil reservoir, which is provided with a filling plug 18 and a drain plug 19. At the rear of the crank case, a hand hole 20 is provided for access to the interior of the crank case for tightening bearings and the like without dismantling the engine. A plate 21 is fitted in an oil tight manner over the hand hole 20.

At the forward end of the cylinder 13, a flat seating surface is formed against which the cylinder head 22 is fitted. Said cylinder head is conventional in construction, being provided with inlet and exhaust valves and a spark plug 23. A cored passage 24 formed in the cylinder head communicates with the cylinder through the inlet valve and with a simple carburetor 25. Air is delivered to said carburetor through an inlet conduit 26, the opening of which is covered by a spring pressed cap 27. Said cap is normally held above the opening to the inlet conduit by the spring 28. For starting the engine, the operator may choke the inlet conduit by pressing the cap 27 downwardly against the inlet to the conduit 26. A manually controlled needle valve 29 supplies liquid fuel to the Venturi throat of the carburetor from a conduit 30, which extends downwardly into a fuel tank 31 secured beneath the engine block between the runners 12 by brackets 32.

A throttle valve 33, carried by a throttle shaft 34 rotatably mounted in the cylinder head with the throttle valve positioned in the cored passage 24, is provided for regulating the flow of fuel mixture to the engine. The throttle shaft 34 is positioned in alignment with an extension shaft 35 and is secured against rotation with respect to said shaft by a connecting sleeve 36. The connection between the sleeve 36 and the throttle shaft 34 is in the nature of an axially separable slip joint whereby the head 22 may be removed and replaced without disturbing the governor setting as controlled by the shaft 35. The slip

joint is formed to be engageable only at certain angular positions with the throttle valve in proper position relative to the control shaft. The shaft 35 is positioned in a bore 37 formed below the cylinder 13 in the cast unit block previously described. Said shaft is provided with a bearing member 38 at the crank case end of the bore 37. A small bell crank lever 39 is secured against rotation on the end of the throttle shaft extension 35 within the crank case. A spring 40 abuts said lever and the member 38 for resiliently holding the respective elements in position, taking up all lost motion.

The closed side of the crank case as formed by the casting 10 is provided with an inwardly projecting boss 41, which is bored to form supporting means for a bearing sleeve 42 in which the crank shaft 43 of the engine is rotatably mounted. A baffle wall 44, extending from above the boss 41 downwardly and over said boss, forms an oil pocket for receiving oil normally splashed about the crank case in the operation of the engine. An opening 45 from said pocket delivers oil to the crank shaft bearing. A Welch plug 46 closes the outer end of the bore 42 against the escape of oil. A drain opening 47 is formed adjacent said plug for the return of oil to the crank case.

A side cover plate 48 is provided with a faced portion 49 fitting the face 17 previously described as being formed around the open side of the crank case. A plurality of centering pins 50 are utilized to accurately center the covering plate in position when it is being attached to the crank case by studs, cap screws, or other suitable means. The cover plate 48 is formed with a boss 51 provided with a bore, axially aligned with the bore in the boss 41. A bearing sleeve 52 within said bore forms the other bearing for the crank shaft 43. The pins 50 are provided to assure co-axial alignment of the crank shaft bearings. A baffle 53 forms an oil pocket above the boss 51, from which oil is delivered through an opening 54 to the crank shaft bearing. An oil seal assembly 55 surrounds the projecting end of the crank shaft 43 to prevent the escape of oil from the crank case. A flywheel 56 is rotatably secured on the projecting end of the crank shaft.

The crank shaft 43 is provided with the usual crank bearing 57 and counter-weights 58 for balancing the connecting rod 59 and the piston 60, this portion of the engine being conventional in construction.

An inwardly extending boss 61 is formed with a bore and a suitable bearing sleeve 62 mounted therein, to provide a bearing for the cam shaft 63. A baffle 64 above the boss 61 forms an oil pocket, from which oil is deliverd through an opening 65 to the cam shaft. A unit oil seal assembly 63' is provided around the projecting end of the cam shaft for preventing the escape of oil therefrom. A drain conduit 66 delivers oil from the cam shaft bearing to the oil pocket formed by the baffle wall 44. It will be noted that the cam shaft 63 is of a relatively large size, being constructed to carry the full load of the engine. A drive pulley 67 is rigidly secured to the projecting end of the cam shaft 63.

The cover plate 48 is provided with a boss 68 formed with a bore and a suitable bearing sleeve 69 mounted therein to provide a second bearing for the cam shaft 63. A baffle wall 70 forms an oil pocket, from which oil is delivered to the cam shaft through an opening 71. Oil is drained from the bearing by a cored passage 72 into the oil pocket formed by the baffle 53. A Welch plug 73 closes the outer end of the bore against the escape of oil.

A gear 74 keyed on the cam shaft 63 meshes with and is driven by a gear 75 keyed on the crank shaft 43. Cams 76 formed on the cam shaft provide means for operating the valves of the engine, as in conventional design. Figure 1 shows one of the tappets 77 mounted for reciprocation in a bore formed in the block of the engine. Horizontally cored passages 78, one of which can be seen in Figure 1, provide for the reciprocation of push rods 79, which contact with the tappets 77 and operate the valves of the engine through rocker arms 80. This particular tunnel construction through the engine proper is disclosed and claimed in the Bechman patent previously referred to.

At the bottom of the crank shaft, near the open side, an upwardly projecting extension 81 is formed with a transverse horizontal bore 82, in which a hollow governor shaft 83 is rotatably mounted. Said shaft is provided with a shoulder 84 at its outer end, which abuts the extension 81 around the bore 82. At its inner end, a gear 85 is rigidly secured to the shaft 83. Said gear meshes with and is driven by the gear 75 on the crank shaft.

The gear 85 is particularly formed with a web 86 having diametrically located openings 87 there-through. Spaced ears 88 extending inwardly adjacent the openings 87 are provided with aligned apertures, through which pins 89 extend, forming pivot points for governor weights 90. Said weights are provided at one end with extensions, which are properly weighted to secure the desired operative pressure on the governor mechanism during operation of the engine. At their other ends, said weights are provided with pressure fingers 91, which are positioned to exert, through cam faces axial pressure on a governor plunger 92 mounted for reciprication in the hollow shaft 83. An extension 93 of the plunger 92, reduced in diameter, extends outwardly beyond the shoulder 84 on the hollow shaft and engages a seat 94 formed on a governor lever 95. The lever 95 is pivotally supported at its fulcrum point on an adjustable bracket 96. The other end of the governor lever 95 is connected by a link 97 with the lever 39 previously described.

A sleeve member 98 is slidably fitted into the outer end of the hollow shaft 83. At the outer end of said member a small diameter bore forms an opening, through which the reduced portion 93 of the governor plunger 92 extends. Within the hollow shaft, the member 98 is provided with a larger bore forming an annular space between said member and the extension 93. A spring 99 surrounding the extension 93 abuts the plunger 92 and the member 98, resiliently urging said member outwardly and the plunger 92 inwardly toward the governor fingers 91.

A bell crank member 100 is pivotally mounted on the bracket 96 co-axially with the lever 95. Said member is provided with two spaced lever arms 101, which are provided with upturned end portions forming cam-like surfaces seating on the outer end of the sleeve member 98 on opposite sides of the extension 93 of the governor plunger 92.

The member 100 is also provided with an outwardly extending lever 102, which abuts the inner end of a threaded member 103 extending through the side plate 48. A lock nut 104 is

provided for securing the member 103 in different positions of adjustment.

In a one-cylinder engine, a breather must be provided, in which an appreciable air flow is permitted, as there is a pulsating action due to displacement by the single piston. It is also obvious that there is considerable agitation of the oil in a closed crank case engine of this type depending upon splashing to distribute the oil. In the construction as illustrated, a specially designed breather has been incorporated in combination with the side plate construction, and forms therewith a part of the present invention. At the upper portion of the side plate 48, an integral breather chamber 105 is formed in the casting forming the plate. Said chamber is divided into an inner compartment 106 and an outer compartment 107. A horizontal, transverse breather conduit 108 extends from a point in the crank case, as shown in Figure 2, in which there is a minimum of oil agitation through the side plate 48 and the compartment 106 into the compartment 107. It will be noted that both ends of the conduit 108 are formed with a plurality of corrugations 109 to prevent the adherence of oil at the edge of the conduit where it might be blown into the conduit during operation of the engine.

As shown in Figure 5, the conduit 108 communicates with the compartment 107 at one side thereof. A vertical, narrow opening 110 is formed in the wall, separating the two compartments at the side opposite the conduit 108. Said slot extends to the bottom of the compartment whereby oil collecting in said compartment may flow into the compartment 106. A conduit 111, cored in the plate 48, communicates with the compartment 106 and with a groove 112 formed in the plate 48 along the overlapping portion of the plate with the attaching flange on the crank case, as best shown in Figure 3. Said groove extends downwardly to the bottom of the plate 48, where it communicates with the crank case by means of a passage-way 113 below the normal liquid level in the crank case. A breather conduit 114 communicates with the upper end of the compartment 106, leading downwardly alongside the engine and communicating with the atmosphere. Said conduit has a threaded end within the compartment 106 to prevent the adherence of oil around the end of the conduit.

The engine as above described is started and operated in the same manner as any conventional engine of the same type. To govern the speed of the engine, the novel governing arrangement described has been utilized. It will be understood from the above description that the throttle valve 33 is controlled by the governor through the lever 95, the link 97, the lever 39, the throttle shaft extension 35, the connecting sleeve 36, and the throttle shaft 34.

The operation of the governor, while similar in some respects to centrifugal governors of this type, is somewhat different due to the particular construction constituting a portion of applicant's invention. The governor weights 90 carried on the gear 85 are constructed to exert sufficient power through the fingers 91 to close the throttle valve readily at comparatively low engine speeds. To overcome this action and to provide for varying the governor speed of the engine, the spring 99 is provided, which acts to counter-balance the pressure exerted by the governor weights on the plunger 92. By means of the sleeve member 98, which abuts the spring 99, and the lever member 100, means are provided for varying the reacting effect of the spring 99 by adjusting the threaded member 103. By this means the governor speed of the engine may be varied as determined by the setting of the member 103.

It will be noted also that the supporting bracket 96 for the throttle controlling lever 95 is adjusably supported. Adjustment may be made at this point to obtain proper running of the engine under different load conditions and to provide for adjustment to compensate for wear.

As another portion of applicant's construction, the breather, which is an important part of an engine of this type, is formed on the removable cover plate 48 as a simplified, unitary construction. The crank case communicating conduit 108 in no way interferes with the internal mechanism of the engine and is removed with the cover plate for inspection or cleaning. The conduit 114 is also carried with the cover plate and is removable therewith. The oil draining means, which must necessarily communicate with the crank case below the liquid lever therein, is formed by the unique groove construction which cooperates with the attaching flange to form a drain passageway. By removing the side plate, the drain conduit is not only automatically disconnected, but is open throughout its entire length for cleaning. This feature in itself is a portion of the novel side plate construction as devised and constructed and embodied in the engine as disclosed.

It is to be noted also that the governor control member 103 is removed with the side plate without altering the governor adjustment. During reassembly, governor readjustment should not be necessary, as the setting is not changed when removing the plate 48.

In the above description, the spark plug 23 was referred to as forming the ignition means, being supplied with current by a magneto. A high tension conductor 115 connects the spark plug with a high tension magneto 116. Said magneto is bolted onto an extension of the crank case and is provided with a gear 117 shown in dotted lines in Figure 1, which meshes with the gear 74 on the cam shaft of the engine. The magneto is supplied with a conventional timing mechanism for delivering current to the spark plug at the proper time intervals.

Although applicant has shown and described only a preferred construction of his improvement in internal combustion engines, it is to be understood that he claims as his invention all modifications falling within the scope of the appended claims.

What is claimed is:

1. In an internal combustion engine and in combination, a unitary casting embodying a cylinder, a cooling jacket and a crank case, one side of said crank case being open and formed around the opening with an attaching flange, a side plate fitted over the opening and secured rigidly in position against the attaching flange, inwardly projecting aligned bosses on the side plate and on the closed side of the crank case, and a crank shaft, said shaft being journaled in the boss on the crank case at one end and in the boss on the side plate at the other end.

2. In an internal combustion engine and in combination, a unitary casting embodying a cylinder, a cooling jacket and a crank case, one side of said crank case being open and formed around the opening with an attaching flange, a side plate

fitted over the opening and secured rigidly in position against the attaching flange, a cam shaft, a crank shaft, said shafts being journled in the crank case at one end and in the side plate at the other end, a breather compartment formed in the side plate, conduits carried by the side plate being provided communicating with said compartment and with the crank case and the atmosphere, and an oil drain conduit communicating with the compartment and with the crank case below the normal liquid level therein.

3. In an engine having a removable side plate forming a part of a closed crank case and in combination, a breather compartment formed in the side plate, conduits communicating with said compartment and with the crank case and the atmosphere, and an oil drain conduit communicating with the compartment and with the crank case below the normal liquid level therein.

4. In an engine and in combination with the throttle valve and crank shaft thereof, a hollow governor shaft mounted for rotation on the engine, a gear for driving said shaft from the crank shaft of the engine, said gear being formed with openings therethrough, governor weights pivoted on the gear, a push rod mounted for reciprocation in said shaft, said rod being engaged at one end by the governor weights, a throttle operating lever operatively engaged by the other end of said rod and with the throttle valve, a spring engageable with the push rod for counter-balancing the governor action, and adjustable means for regulating the counteracting pressure exerted by said spring.

5. In an engine and in combination with the throttle valve shaft and crank shaft thereof, a hollow governor shaft mounted for rotation on the engine within the crank case, means for driving said shaft from the crank shaft of the engine, governor weights, a governor shaft, a push rod mounted for reciprocation in said shaft, said rod being engaged at one end by the governor weights, a throttle control lever operatively engaged by the other end of said rod and with the throttle valve shaft, a spring positioned to resist the force exerted by the governor weights, and adjustable means extending exterior of the crank case for adjusting the pressure exerted by said spring.

6. In an engine and in combination with the throttle valve and crank shaft thereof, a hollow governor shaft mounted for rotation on the engine, means for driving said shaft from the crank shaft of the engine, governor weights pivoted on the governor shaft, a push rod mounted for reciprocation in said shaft, said rod being engaged at one end by the governor weights, a throttle opening lever operatively engaged by the other end of said rod and with the carburetor, a spring within the hollow shaft surrounding the push rod and engaged with said rod to resist the force exerted by the governor weights, a sleeve fitted around the push rod and against said spring, and adjustable means for adjusting the position of said sleeve.

7. In an engine and in combination with the throttle valve shaft and crank shaft thereof, a hollow governor shaft mounted for rotation on the engine within the crank case, a gear for driving said shaft from the crank shaft of the engine, said gear being formed with openings therethrough, governor weights extending through said openings and pivoted on the gear, a push rod mounted for reciprocation in said shaft, said rod being engaged at one end by the governor weights, a throttle control lever operatively engaged by the other end of said rod and with the throttle valve shaft, a spring within the hollow shaft surrounding the push rod and engaged with said rod to resist the force exerted by the governor weights, a sleeve fitted around the push rod and against said spring, and adjustable means extending exterior of the crank case for adjusting the position of said sleeve.

8. In an engine having a cylinder block and an enclosed crank case, and in combination with the throttle valve and crank shaft thereof, a hollow governor shaft mounted for rotation on the engine, a gear for driving said shaft from the crank shaft of the engine, governor weights pivoted on the governor shaft, a push rod mounted for reciprocation in said shaft, said rod being engaged at one end by the governor weights, the cylinder block being formed with a bore extending from the crank case to the throttle valve, a throttle operating shaft in said bore, and a throttle operating lever operatively engaged by the other end of the push rod and with the throttle operating shaft.

9. In an internal combustion engine and in combination, a unitary casting embodying a cylinder, a cooling jacket and a crank case, one side of said crank case being open and formed around the opening with an attaching flange, a side plate fitted over the opening and secured rigidly in position against the attaching flange, inwardly projecting aligned bosses on the side plate and on the closed side of the crank case, a crank shaft, said shaft being journaled in the boss on the crank case at one end and in the boss on the side plate at the other end, and baffle walls extending upwardly from said bosses forming oil pockets for receiving oil splashed in the crank case and delivering it to the crank shaft bearings.

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