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A. E. KOLBE

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INTERNAL COMBUSTION ENGINE

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2 Sheets-Sheet 1

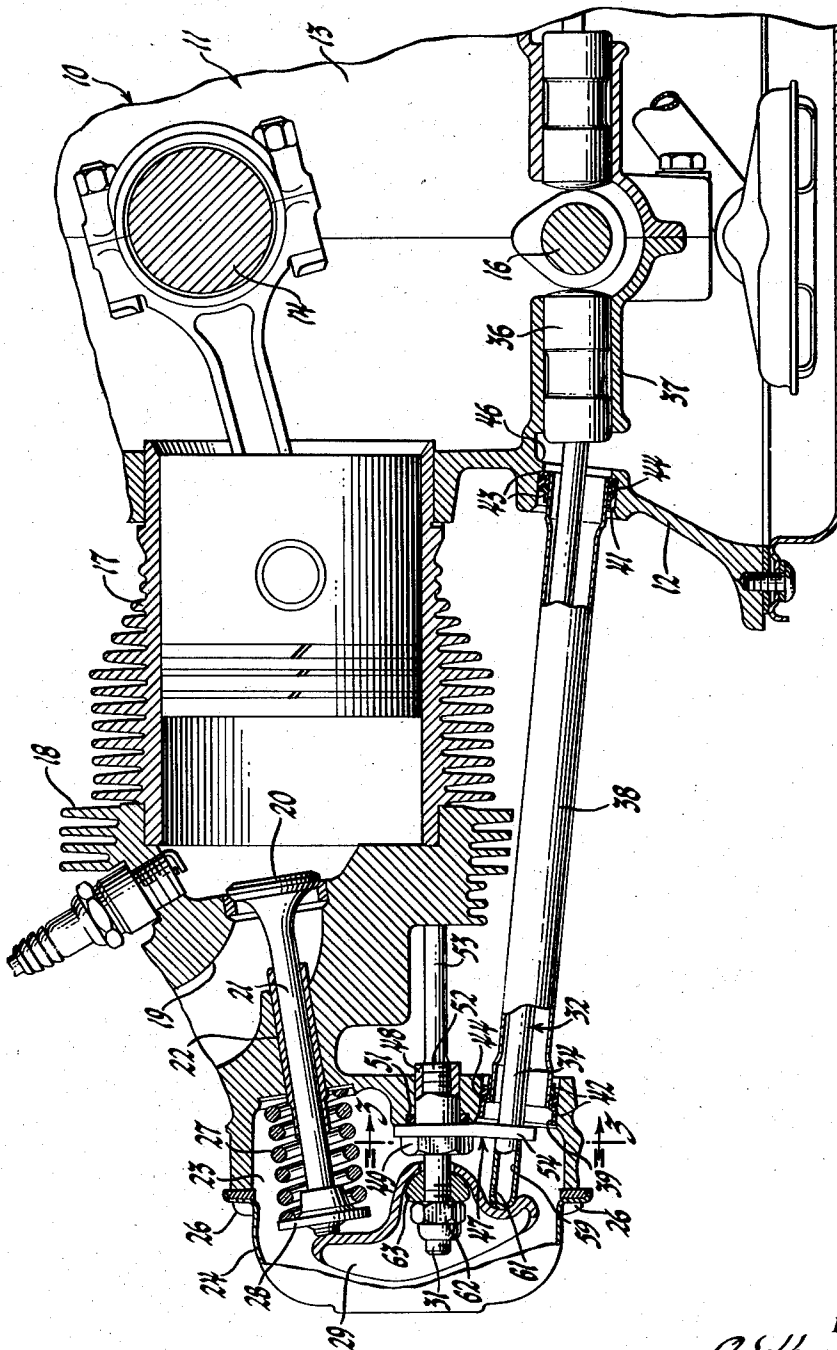


Fig. 1

INVENTOR.
Adelbert E. Kolbe
BY
L. D. Purch
ATTORNEY.

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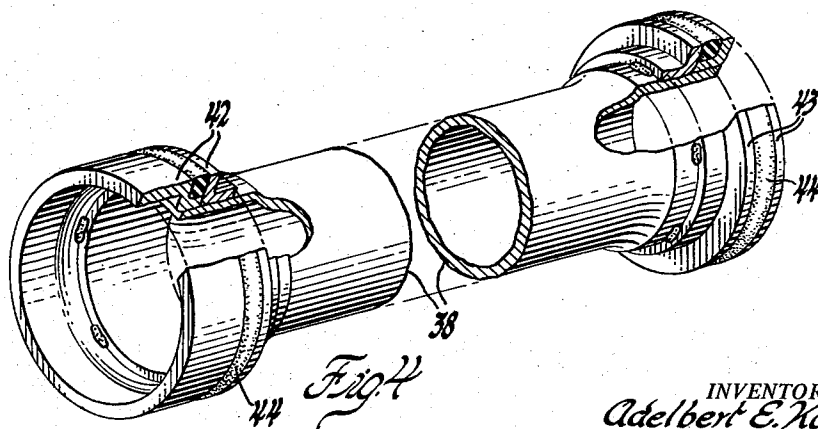
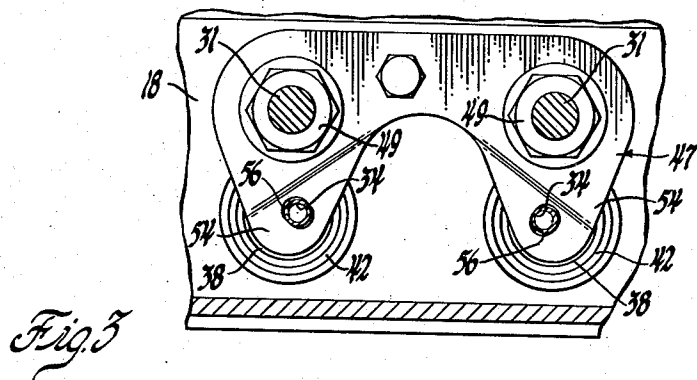
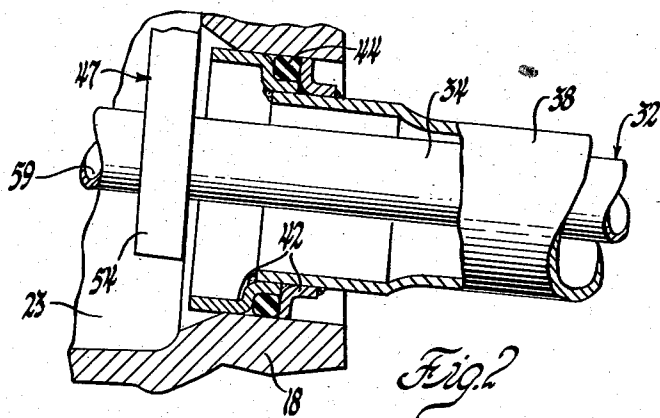
A. E. KOLBE

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2 Sheets-Sheet 2



INVENTOR,
Adelbert E. Kolbe
BY
S. D. Burch
ATTORNEY

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INTERNAL COMBUSTION ENGINE

Adelbert E. Kolbe, Berkley, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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This invention relates to internal combustion engines, and particularly to a novel means for draining lubricating oil from the rocker arm compartment to the crankcase and for securing the draining means in operative position. The internal combustion engine embodying the invention is a 180° opposed six cylinder engine for automotive and other purposes. In this engine the crankcase, the cylinders and the heads for each row of cylinders are secured together by bolts secured in the crankcase and the head for each row of cylinders. The securing means in the heads for certain of these bolts also acts as supporting means for supporting the rocker arms for actuating in the valves of the engine. The supporting and securing means also is employed for securing tubular push rod and lubricating oil return conduits between the heads and the crankcase. By such construction, the conduits, the rocker arms, and the cylinders and heads all may be released by releasing the fastening means for the rocker arm supporting and securing means.

In the drawings:

Figure 1 is a fragmentary cross-sectional view of a 180° opposed cylinder internal combustion engine that may be employed for automotive or other purposes.

Figure 2 is an enlarged fragmentary view of the outer end of one of the tubular oil return and push rod enclosing conduits and the means employed in the heads for securing the conduits in place.

Figure 3 is a fragmentary cross-sectional view through the rocker arm supporting means and particularly illustrating the means for securing the lubricating oil return and push rod enclosing conduits in place in the engine disclosed by Figure 1. Figure 3 is taken in the plane of line 3—3 on Figure 1, looking in the direction of the arrows.

Figure 4 is a perspective view of one of the push rod enclosing conduits employed in the engine disclosed by Figure 1.

The engine 10 embodies an engine frame 11 including crankcase sections 12 and 13 having bearings formed therein and adapted to be secured together on the journals of the crankshaft 14 and camshaft 16 of the engine. The crankcase sections 12 and 13 have rows of openings therein in which the inner ends of cylinders 17 project. The rows of cylinders 17 have heads 18 closing the outer ends of the cylinders and supporting valves 20 controlling the inlet and exhaust passages in the heads and leading to each cylinder 17 of the engine. One of the inlet passages is indicated at 19. The valves 20 have stems 21 slidably disposed in valve guides 22, the outer ends of the stems 21 being long enough to project into rocker arm compartments 23 formed in each of the heads 18. The rocker arm compartments may have removable covers 24 that may be secured in position by any suitable means such as bolts 26. The valves 20 are normally held in closed position by valve springs 27 that may be compressed between the heads 18 and valve spring washers 28 secured on the outer ends of the stems 21. The valves 20 may be actuated by rocker arms 29 secured for piv-

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otal movement in the compartments 23 on rocker arm supports 31. The rocker arms 29 are secured on the outer ends of the supports 31 by nuts 62 and by hemispherical bearings 63. The rocker arms 29 are actuated by push rod means 32 that extend between the rocker arms and the camshaft. In the present instance, the push rod means may consist of push rods 34 and valve lifters 36, the latter being reciprocally supported in guide openings formed in bosses 37 formed as a part of the crankcase sections 12 and 13. The push rods 34 are adapted to be received in tubular push rod conduits or means indicated at 38 and having the opposite ends thereof disposed in aligned openings 39 and 41 formed in the heads 18 and crankcase sections 12 and 13 respectively. The ends of the conduits 38 may have spaced and flanged collars 42 and 43 secured thereon to provide grooves to receive rubber or other suitable resilient sealing bands or rings 44. The bands 44 are adapted to be distorted by the surfaces of the heads and the crankcase sections forming the openings 39 and 41 for sealing the conduits 38 in the openings in the crankcase sections and heads. The openings 41 in the crankcase sections 12 and 13 have annular shoulders 46 formed in the inner extremities thereof for limiting the movement of the conduits 38 inwardly of the crankcase and the openings 41. The openings 39 are large enough to allow both ends of the conduits 38 to pass through the openings so that the conduits may be entirely removed from the engine by withdrawing the conduits through the heads and away from the shoulders 46. The conduits are held in the openings 39 and 41 and adjacent the shoulders 46 by brackets 47. The brackets 47 have openings therein through which the enlarged ends 48 of rocker arms supports 31 project. The enlarged ends have heads 49 engaging the brackets and holding the brackets against the heads 18. The enlarged ends 48 are rotatably mounted in cylindrical openings formed in an outer wall 50 of the heads 18 thereby rigidly supporting the rocker arms 29 during the operation of the engine. Sealing rings 51 may be employed at the outer extremities of the cylindrical openings receiving the ends 48 to seal the openings against leakage of oil from the compartments 23.

The enlarged ends 48 are also internally threaded for receiving the threaded ends 52 of bolts 53. Bolts 53 are two of several bolts for each cylinder employed in holding the heads opposite each cylinder 17 to the crankcase of the engine. The inner ends of the bolts 53 for each cylinder are secured in the crankcase sections 12 and 13. When the heads 49 formed on the ends 48 are turned, it will be apparent that the threads 52 on the bolts 53 and the ends 48 will tighten the bolts 53 and will tighten the heads 49 against the brackets 47. The brackets 47 have ends 54 that extend over the openings 39 in which the outer ends of the conduits 38 extend. There is a certain amount of clearance between the outer ends of the conduits 38 and the bracket ends 54 but this clearance merely allows for the expansion of the conduits 38 without stressing the conduits 38. However the clearance is not enough to allow the opposite ends of the conduits 38 to move an appreciable distance away from the shoulders 46. The bracket ends 54 have elongated openings 56 that are adapted to seal the outer ends of the push rods 32. The elongation of the openings 56 is sufficient to permit angular movement of the outer ends of the push rods which will result from the operation of the rocker arms 29. The bracket ends 54 also are curved at the ends around the axes of the conduits 38, the curvature being greater than the curvature of the inside surface of the outer ends of the conduits 38. This difference in curvature provides passage means around the ends 54 and particularly at the lower extremities of the ends 54 so that communication between the rocker arm compartments 23 and the con-

duits 38 is not closed. Such passage means therefore provides continuous communication between the crankcase 13 and the rocker arm compartments 23. The location of the openings 41 in each of the heads is at the lower part of each of the rocker arm compartments 23. The location of the openings 41 in the crankcase sections 12 and 13 is below the openings 39 so that the conduits 38 slope downwardly from the compartments 23 to the crankcase 13.

The engine is provided with a lubrication system which supplies oil under pressure to all the moving parts of the engine. The valve lifters 36 have interior chambers supplied with oil by this system and which communicate with passages 59 extending throughout the length of the push rods 34. The inner ends of the push rods are provided with jet openings 61 which communicate with the passages 59 and direct oil under pressure supplied by the passages 59 to the rocker arm compartments 23. The oil supplied by the openings 61 strikes the rocker arms 29 and forms a mist to lubricate the valve stems, the valve springs, the rocker arms, the rocker arm supports and the contacts between the push rods and the rocker arms. The oil in the rocker arm compartments 23 will collect in the lower parts of the rocker arm compartments and will flow through the passages around the bracket ends 54 and into the crankcase 13 through the conduits 38. When the rocker arm covers 24 are removed by loosening the bolts 26, it will be possible to loosen the nuts 62 and to remove the rocker arms 29 and the bearings 63. If it is then desired to remove the conduits 38, this may be done by operating the heads 49 of the support ends 48 thereby loosening the threads 52 securing the outer ends of the bolts 53. The supports 31 and the brackets 47 then may be removed from the heads 18. Thereafter, the push rods 34 and the conduits 38 may be pulled outwardly through the openings 39 in the heads 18 and the valve lifters 36 may be removed through the openings 41. Loosening of the threads engaging the bolts 53 may to some extent loosen the cylinder heads and cylinders. However, the remaining bolts securing the heads and the cylinders to the crankcase will hold the heads and the cylinders assembled on the crankcase.

What is claimed is:

1. An internal combustion engine having a frame with a crankcase and a cylinder and a cylinder head formed therein and a crankshaft and a camshaft mounted in said crankcase, a reciprocable piston in said cylinder, a connecting rod connecting said piston with said crankshaft for operating said crankshaft, valve means for said cylinder for controlling the operation of said cylinder, operatively associated rocker arm means and push rod means actuated by said camshaft and operating said valve means, said frame being formed to provide a rocker arm compartment in said head, said compartment enclosing said rocker arm means and parts of said valve means and push rod means extending into said compartment, tubular means connecting said crankcase and said compartment and enclosing said push rod means, opening means formed in said crankcase and receiving one end of said push rod means and said tubular means, said crankcase at the inner extremity of said opening means being formed to provide shoulder means limiting the inward movement of said tubular means relative to said crankcase, said head also being formed to provide opening means communicating with said compartment and receiving the other end of said push rod means and said tubular means, means lubricating said valve means and

said valve operating means in said compartment, said opening means and said tubular means being disposed to communicate with the lower part of said compartment and to slope downwardly toward said crankcase to drain said lubricating oil supplied to said valve means and said valve operating means back to said crankcase, sealing means associated with the ends of said tubular means and sealing said tubular means in said opening means, support means on said head for supporting said rocker arm means in said compartment, and a bracket clamped between said support means and said head and extending over said opening means in said head and limiting the movement of said tubular means away from said shoulder means in said crankcase and providing passage means through said opening means and said tubular means for draining said lubricating oil from said compartment to said crankcase.

2. An internal combustion engine having a frame with a crankcase and a cylinder and a cylinder head formed therein and a crankshaft and a camshaft mounted in said crankcase, a reciprocable piston in said cylinder, a connecting rod connecting said piston with said crankshaft for operating said crankshaft, valve means for said cylinder for controlling the operation of said cylinder, operatively associated rocker arm means and push rod means actuated by said camshaft and operating said valve means, said frame being formed to provide a rocker arm compartment in said head, said compartment enclosing said rocker arm means and parts of said valve means and push rod means extending into said compartment, tubular means connecting said crankcase and said compartment and enclosing said push rod means, opening means formed in said crankcase and receiving one end of said push rod means and said tubular means, said crankcase at the inner extremity of said opening means being formed to provide shoulder means limiting the inward movement of said tubular means relative to said crankcase, said head also being formed to provide opening means communicating with said compartment and receiving the other end of said push rod means and said tubular means, means lubricating said valve means and said valve operating means in said compartment, said opening means and said tubular means being disposed to communicate with the lower part of said compartment and to slope downwardly toward said crankcase to drain said lubricating oil supplied to said valve means and said valve operating means back to said crankcase, sealing means associated with the ends of said tubular means and sealing said tubular means in said opening means, bolts means extending from said head to said crankcase and secured in said crankcase for securing said head and said cylinder and said crankcase together, support and securing means on said head and supporting said rocker arm means in said compartment and securing said bolt means in said head, and a bracket clamped between said support and securing means and said head and extending over said opening means in said head and limiting the movement of said tubular means away from said shoulder means in said crankcase and providing passage through said opening means and said tubular means for draining said lubricating oil from said compartment to said crankcase.

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