

[54] POWER TRANSMISSION SYSTEM AND METHOD

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[58] Field of Search **92/126, 165, 178, 187; 123/197 R, 197 A, 197 AB, 197 AC, 119 R**

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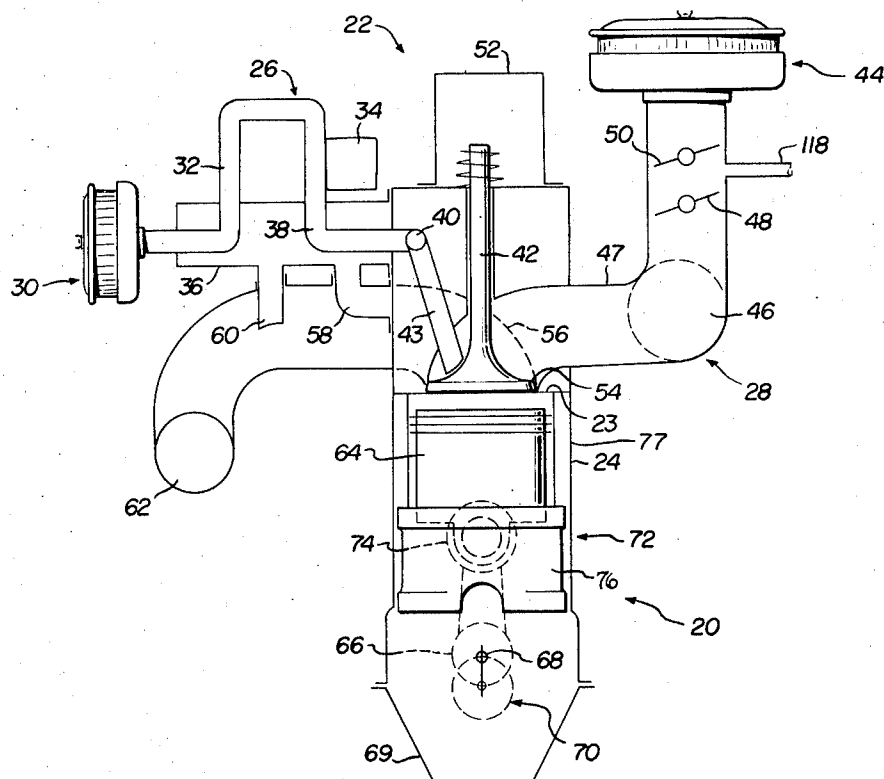
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[57] ABSTRACT

An emission control system for an internal combustion engine, including a dual induction system adapted to provide to said engine a relatively low power fuel-air mixture and accomplishing thereby a substantially emission free exhaust, as pertains to the fuel alone. The dual induction system allows the engine piston speed and its associated crank shaft speed to be increased to a point beyond the known mechanically allowable limits of piston reciprocating (sliding) speed, to recover the potential engine power lost to the use of only the relatively low power mixture. The engine includes also, a roller crosshead assembly enabling the engine to operate indefinitely at such power and speed increases, and as limited by sources other than the crosshead alone. The dual induction system includes a cold-air intake system adapted to supply to the engine, all of the unheated air inducted by said engine, and a hot intake system supplying all of the fuel in a highly heated state and a small percentage of the total inducted air, equally as highly heated. The roller crosshead assembly includes a roller mounted upon the connecting rod wrist pin and a pair of opposed roller guideways supported in the engine cylinders by a cup-shaped guide member. The roller rolls upon the guideways, eliminating lateral axial movement of the piston upon the cylinders during its inward and outward movement, and permitting thereby, indefinitely long operating periods at the increased engine crank shaft and piston speeds. The roller crosshead assembly enables the engine lubricating oil to be excluded from the combustion portion of the engine's cylinders and thereby eliminating the exhaust emission arising from combustion and/or partial combustion of the oil during combustion of the fuel.

12 Claims, 5 Drawing Figures



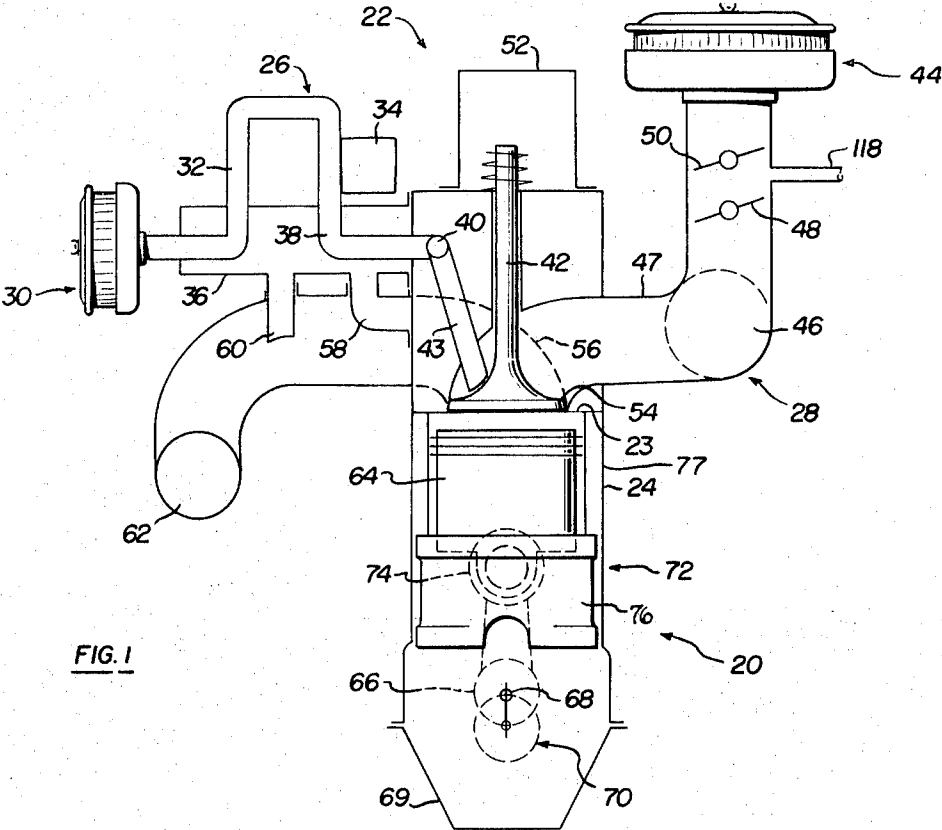
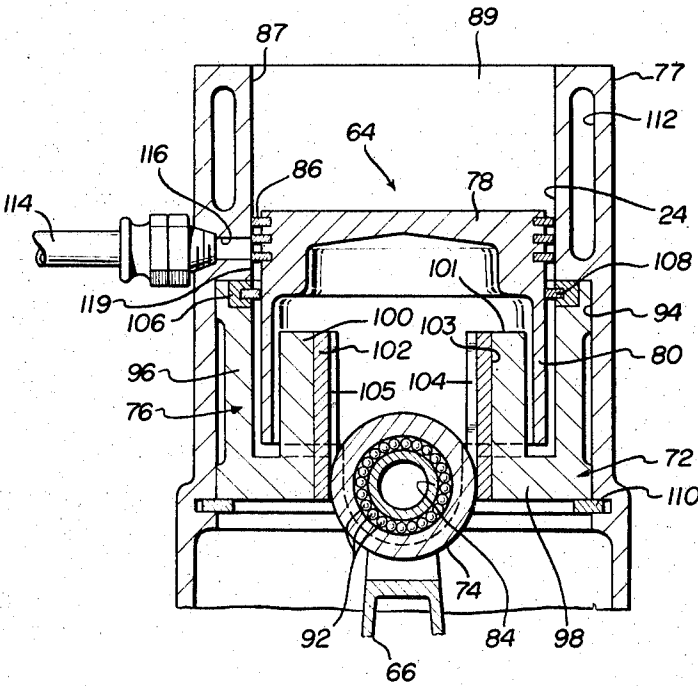


FIG. 2



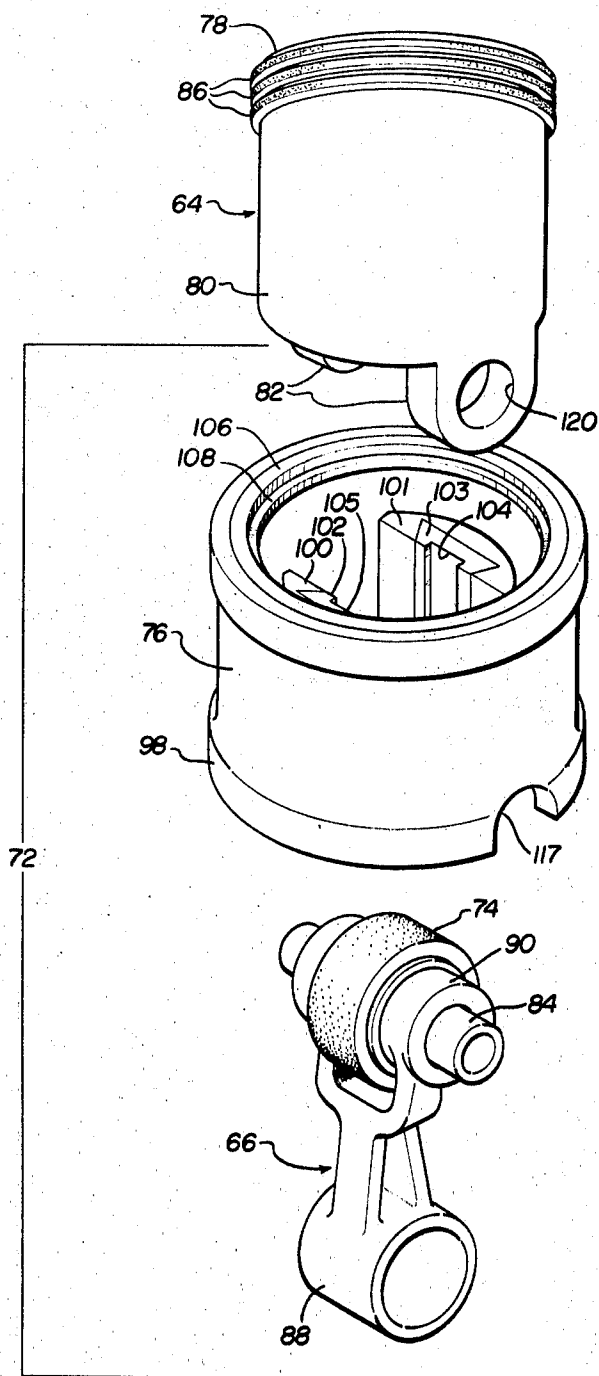


FIG. 5

POWER TRANSMISSION SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

The power output of a conventional internal combustion engine is dependent upon the fuel content of the fuel-air mixture. The present engines attain maximum power relative to any engine speed, with approximately 8 percent fuel relative to the air, by weight, in the mixture, which results in a "dirty" exhaust, including unburned hydrocarbons, carbon monoxide and nitrogen oxide gases. Further, the fuel-air ratio cannot be effectively reduced in a conventional internal combustion engine, without severe loss of power, and without intolerable operational difficulties because its single intake induction system cannot concentrate at the cylinder's spark plug, sufficient fuel of a leaner mixture, to enable consistent ignition and/or adequate stoichiometrical combustion of the mixture.

The maximum speed of a conventional internal combustion engine is limited by (1) the ability of the engine to "breathe," or rapidly induct sufficient air to 90 percent fill the cylinder, and (2) the piston reciprocating (sliding) speed. The maximum allowable engine speed in a conventional, commercial, internal combustion automotive engine is approximately 4,000 revolutions per minute. At greater speeds, the cylinders cannot be adequately filled with mixture, which results in loss of torque and power. A supercharger can significantly fill the cylinders at increased engine rpm, but it is additional equipment and expense. Assuming, however, that the engine speed were to be increased by supercharging a conventional internal combustion engine, the piston wear upon the cylinders' internal wall would prematurely destroy the cylinders and the pistons.

The disclosed internal combustion engine very nearly eliminates all emissions by enabling a substantial reduction of the fuel in the fuel-air mixture and offsets the potential power loss from such reducing of mixture proportions by enabling an increase of the engine speed beyond the normal mechanically allowable limits of piston reciprocating (sliding) speed. This increased piston reciprocating speed is permitted by utilizing a novel roller crosshead assembly which eliminates the connecting rod forces on the pistons and cylinders. These forces also wear the cylinder out-of-round and into an oval shape. As such wear is occurring, the piston rings commence allowing increased combustion gas leakage from the cylinder and into the crankcase to add to the emissions and the general air polluting situation. The roller crosshead eliminates such wear and such leakage. Furthermore, the worn oval shape cylinders allow engine lubricating oil, in the engine's crankcase, to be pumped by the reciprocating pistons, into the combustion portion of the cylinders above the piston heads, and thereafter incompletely burned, and exhausted from the cylinder in that state to form one contributor to polluting exhaust emission known as unburned hydrocarbons. This source of air pollution also becomes substantially nil, by the crosshead usage. The only other known ways to rid the exhaust of this HC emission are with use of after burners pumping fresh air into the exhaust system in order to burn the HC products, or, by catalyzing the exhaust products into non polluting other products; the latter mentioned ways adding to the mechanical complexity of the engine (power plant) and its initial and maintenance expense. The roller

crosshead enables the above stated oil pumping situation to be eliminated by enabling the piston exterior surfaces between the piston rings and the wrist pin, to be sealed off from the lubricating oil in the engine's crankcase.

SUMMARY OF THE INVENTION

As described above, the disclosed internal combustion engine of this invention can run on a substantially leaner fuel-air mixture and therefore normally provides a non-air polluting exhaust as derived from the fuel alone. This is accomplished by utilizing a dual intake system, such as disclosed in my U.S. Pat. No. 2,968,297. This system concentrates the fuel at the spark plug of the cylinders. With the dual induction system, the engine can operate satisfactorily on approximately a 4 percent overall fuel-air mixture, however, the power output is thereby reduced proportionately as the mixture fuel content. This reduction in potential power output is offset by increasing the engine's speed beyond the known limitation of piston reciprocating (sliding) speed, requiring therefore, the improved rolling crosshead utilized in the present invention.

The improved roller crosshead of this invention eliminates the forces on the pistons resulting from the piston connecting rod and crank shaft rotation, which tend to wear oval the cylinder inside diameter. The pistons are thereby permitted to float within the cylinder; taking the connecting rod thrust off of the piston permits the piston reciprocating (sliding) speed to be increased well beyond the present limitations. The roller crosshead assembly includes a roller which is rotatably received within a pair of opposed guides, within the cylinder, and which eliminates the connecting rod forces on the pistons. Further, in a conventional internal combustion engine, the piston skirt bears upon the cylinder and close tolerances must be maintained between the pistons and the cylinder walls to obtain quiet running. In the present invention, only the head portion of the piston is loosely fitted within the cylinder. The skirt portion clears the cylinder and extends within a cup-shaped member spaced from the piston skirt. The cup-shaped member includes a sealing ring biased against the piston skirt, which prevent "blow-by" of combustion gas from the combustion portion of the cylinder, from entering the crankcase, and prevent lubricating oils from entering the combustion area of the cylinder.

The disclosed dual induction system includes a cold-air intake system adapted to supply substantially all of the air inducted by the engine cylinders and a hot intake system adapted to supply all of the engine's fuel requirements and a small percentage of the air. The hot intake system includes a carburetor and a heater to heat the incoming air and fuel. The carburetor supplies substantially less than normal requirements of fuel for full power output of the engine at any specific speed, resulting in a potential power loss which is offset by the dual induction system in conjunction with higher engine maximum rpm, or its equivalent piston reciprocating speed.

The crosshead guide means permits the pistons to float axially within the cylinders during their reciprocation and eliminates the forces of the connecting rods which otherwise would be borne by the pistons and their respective cylinders, and thereby permitting the engine to operate at a speed well above the normal limitation of piston reciprocating (sliding) speed. The en-

gine crank shaft speed may then be increased to offset the potential power loss resulting from the lean fuel-air mixture. This is accomplished by the dual induction system, as described in my above referenced U.S. Pat., incorporated by reference.

The roller crosshead permits also, a relatively much larger ratio of piston diameter to piston stroke, than is otherwise mechanically allowable, whereby an extremely short piston stroke becomes advantageously mechanically practicable, which, in combination with a much larger piston diameter enables an engine construction combination of: 1) a vertical or horizontal configuration; 2) one-half as many cylinders; 3) approximately one-half as much weight; 4) much higher crank shaft rotational speed to obtain as much and even more power per cubic inch of piston displacement, than currently being obtained with naturally aspirated (not supercharged) engines; 5) less combustion temperature derived from the high allowable ratio of piston diameter to piston stroke, whereby combustion produced nitrogen oxide (NOX) becomes mechanically controllable and lessened; 6) less overall engine height from the crank shaft center of rotation to the top of the engine, than the currently conventionally configured and constructed automotive engines, particularly, with crosshead usage, wherein normally the engine height becomes increased by as much as the piston stroke's length; and, 7) in short, a smaller engine ensues, for a specific power output.

Other advantages and meritorious features of the disclosed emission control system and internal combustion engine will be more fully described in the following description of the preferred embodiment, the appended claims and the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of the improved internal combustion engine of this invention;

FIG. 2 is a side cross-sectional view of the roller crosshead assembly and one engine cylinder;

FIG. 3 is a partial top elevation of the engine cylinders, partially broken away to show the rolling crosshead; FIG. 4 is a partial cross-sectional view of FIG. 3, in the direction of view arrows 4—4; and

FIG. 5 is an exploded view of the roller crosshead assembly and piston.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 illustrates schematically one embodiment of an internal combustion engine 20 having a dual induction system 22, such as shown in my above referenced U.S. Pat. The dual induction system described in my above referenced patent is adapted to increase the engine speed and the disclosed invention utilizes this dual induction system to reduce the emissions of the engine, including unburned fuel and oil hydrocarbons, carbon monoxide gas and nitrogen oxide gas. As described above, these emissions result from the utilization of a rich fuel-air mixture containing about 8 percent fuel relative to air, by weight, which is required by the conventional single induction system engine. The dual induction system evenly distributes the fuel to the inlet ports 23 of the cylinders 24. The dual induction system is adapted to convey the fuel to the inlet port 23 and concentrates it at the cylinder spark plug, and increases the engine speed by not conveying fuel in the cold in-

take system which then can be of any area size needed for any elected engine speed wanted. It has now been found that the dual induction system permits the engine to run on a leaner fuel-air mixture, which results in a clean, emission free exhaust.

The dual induction system includes a hot intake system 26 which supplies a small percentage of the air inducted by the engine cylinders and all of the fuel. The cold-air intake 28 supplies the remainder of the air inducted by the engine.

The hot intake includes a conventional air cleaner 30 which provides the air inlet port, an air passage 32 to the carburetor 34, a heater 36 which heats the fuel and air mixture in the mixture passage 38 and an intake manifold 40 which distributes the fuel-air mixture to the cylinder inlet valves 42, through passage 43.

The cold-air intake 28 also includes a conventional air cleaner 4 and manifold 46 which distributes the air to the engine cylinders 24 through inlet 47. The cold-air intake 28 also includes a manual throttle valve 48 and an automatic throttle valve 50, as described in my above referenced U.S. Pat. The cylinder exhaust and intake valve operating mechanism is enclosed within the cover plate 52. In operation, a small percentage of the air enters through air cleaner 30 and line 32, where it is mixed with all of the engine's fuel requirements at carburetor 34. Throttle valves are provided in the fuel-air passage 38, as described in my above referenced patent, and the fuel-air mixture exits from the hot intake system at the head 54 of the inlet valve 42, as shown in FIG. 1. The inlet valve 42 and the inlet port 23 are larger than normal, as described in my above referenced patent, to allow a greater volume of air to pass through the cold-air intake 28.

The cylinder exhaust gas exits through outlet passage 56 to the inlet 58 of the heater 36. The hot gases heat the incoming air in line 32 and the fuel-air mixture in line 38, as described above. The exhaust gas leaves the heater through line 60 and finally through the exhaust pipe 62. As described above and in my above referenced U.S. Pat., the dual induction system shown in FIG. 1 results in an increased engine speed. The speed of an internal combustion engine having the dual induction system shown in FIG. 1, is limited only by the mechanically allowable sliding speed of the reciprocating pistons because the dual induction system overcomes the problem of a single induction system, namely that of supplying sufficient fuel laden air to the cylinders, which otherwise limits the engine speed. The disclosed embodiment of the internal combustion engine of this invention utilizes increased engine speed to provide an emission free exhaust and maintain a former level of maximum power per cubic inch of engine piston displacement that the engine is capable of prior to application of emission controls. The carburetor 34 supplies approximately one-half the normal fuel requirements of that mixture which produces maximum power for any given piston speed.

A conventional internal combustion engine requires approximately an eight percent fuel to air mixture for maximum power output at any specific speed. The disclosed embodiment of the internal combustion engine operates on approximately one-half this amount of fuel in the above mentioned mixture or about a 4 percent of fuel to air mixture. The utilization of even a 6 percent fuel to air mixture in a conventional internal combustion engine is driveably intolerable. It results in op-

erational hesitancy and stalling inoperability of the engine because the fuel in the air cannot be so distributed adjacent the cylinder spark plug to assure consistent ignition of the fuel in the combustion area of the cylinder. The disclosed dual induction system delivers the fuel to the inlet port 23, and concentrates it at the spark plug of the cylinders, as described above, since the spark plug is near the exit of the tube 43 and thereby produces consistent ignition of the fuel and thereby acceptable driveability of the engine.

The internal combustion engine shown in FIG. 1 also includes a plurality of cylinders 24, normally 4, 6 or 8, and pistons 64 thereof connecting rods 66 interconnecting the crank shaft crank pin 68 and the pistons 64 and causing the pistons to reciprocate within the cylinders 24. The swing of the crank pin and the crank pin end of the connection rod 66 is shown schematically at 70 in FIG. 1. As stated above, the dual induction system utilized in the internal combustion engine of this invention enables the engine normal crank shaft rotational speed, to be increased well beyond the known limits of piston sliding speed for a given crank shaft rotational speed. A conventional automotive internal combustion engine operates at approximately 4,000 revolutions per minute and within 3,000 feet per minute piston speed; however, the disclosed internal combustion engine will allow more than double this speed, regardless of the associated piston reciprocating speed. This increase in rotational and piston speed offsets power loss from the utilization of the emission free, lean fuel-air mixture described above. The increased engine speeds, in the disclosed embodiment of the invention, are permitted by the utilization of a unique crosshead assembly 72, which is an adaptation of a double acting piston type steam engine construction to a single acting piston type internal combustion engine shown schematically in FIG. 1 and completely in FIGS. 2 and 5. The assembly 72 includes a guide member 76 for the piston end of the connection rod 66, which in this embodiment of the invention is a roller assembly 74, all of which are described below. The roller assembly 74 can be substituted by a sliding member since it is not exposed to heat as a sliding piston is and can be adequately lubricated.

However, the roller 74 is preferred. The crosshead assembly is shown in detail in FIGS. 2 to 5, wherein FIG. 3 shows one embodiment of the cylinder block 77, including a plurality of cylinders 24 and reciprocating pistons 64 in the block 77. Only one cylinder assembly will be described hereinbelow, however it will be understood that the internal combustion engine of this invention may include any number of pistons and cylinders, as known in the prior art. The disclosed internal combustion engine is an automotive gasoline fueled engine, however the disclosed invention may also be utilized with other fuels.

The piston disclosed in the roller crosshead assembly 72 of this invention is of general, conventional construction, including a head portion 78, a cylindrical annular skirt portion 80, as shown in FIG. 2, and a pair of wrist pin bosses 82, which receive the wrist pin 84 for securement of the pistons 64 to the connecting rod 66. The piston normally includes the well known plurality of rings 86 which sealingly engage the internal wall 87 of the cylinder to prevent excessive gas leakage past the piston.

The unconventionally constructed connecting rod 66 includes a crank shaft boss 88, which rotatably receives the crank shaft 68, as shown in FIG. 4, to permit the crank shaft to rotate within the connecting rod boss. The crank shaft 68 is enclosed within a conventional crank case 69, as shown in FIG. 4, which normally includes a seal 71. The opposed end of the connecting rod 66 includes a wrist pin boss 90 which receives the wrist pin 84 and the roller assembly 74 rotatably mounted on the wrist pin, as shown in FIGS. 2 and 5. The roller assembly 74 preferably includes an anti-friction bearing of the roller type containing rollers or needles 92, as the rollers are generally called and shown in FIG. 2. The roller assembly 74 is rotatably received in the guide member 76, which will be described hereinbelow.

The guide member 76 is mounted within a counter-bore 94 in the cylinder 24, as shown in FIGS. 2 and 4. The preferred embodiment of the guide member is cup-shaped and includes a cylindrical portion 96 and a base portion 98 having an open end for admission of connecting rod 66 and roller assembly 74, as shown in FIG. 2. Two protrusions 100 and 101 formed integral with, and extend from the base 98, toward the piston, as shown in FIG. 2. The protrusions include wear resistant inserts 102 and 103, as shown in FIGS. 2, 3 and 5; each insert having an opposed channel 104 and 105 which rotatably receives the roller assembly 74, as shown in FIG. 2.

The forces of piston sliding wear and the heat generated on both the cylinder and the piston, normally associated with the rotation of the crank shaft 68 and the thrust of the connecting rod 66 upon the piston 64 and the cylinder 24, are thus eliminated by the crosshead assembly 72, shown in FIGS. 2 to 5. Rotation of the crank shaft 68 will move the end 88 of the connecting rod in a circle, as shown at 70 in FIG. 1, causing reciprocation of the piston. The forces of connecting rod 66 are taken up by the roller assembly 74, which is guided within the channels 104 and 105 in the guide member 76, substantially eliminating any sliding and therefore frictional forces on the pistons. The pistons are thus free to float in the reciprocating axis of the cylinder, permitting the greater engine speeds described above.

It will be further noted that the skirt portion 80 of the piston 64 is not in contact with the cylinder 24, and extends into the cylindrical portion 96 of guide member 76. All of the piston clears the cylinder 24, thereby eliminating the accurate tolerances which must be maintained in the conventional piston-cylinder construction. In the disclosed embodiment, the guide member 76 also includes a seal retainer insert 106, adjacent the upper end of the guide, which receives and retains a sealing ring 108 biased against the skirt portion 80 of the piston 64. The sealing ring seals the space between the piston skirt and the guide member, which prevents combustion gases blown past piston ring 86 from entering the crank case 69 and lubricating oils from entering the combustion area 89 of the cylinder. Though not disclosed in the embodiment of FIG. 2, it is to be understood that more than one sealing ring 108 can be used, and in addition thereto, a conventional oil control (scraper) ring may be used to more effectively retain lubricating oils within the engine crankcase. The advantages of this structure are those of rugged construction, assembly and service simplicity and their associated engine economics.

The guide member 76 is retained in place by the retaining ring or snap ring 110. The roller crosshead assembly 72 is an important advantage in any piston type internal combustion engine, but is particularly important in high speed engines which this invention can gainfully be, but not necessarily limited to only high speed engines.

The engine cylinder 24 also includes a plurality of channels 112 which receive the normal engine coolant and an outlet line 114 to receive the blow-by gases through port 116 for conventional recycling into the induction system and the cylinder 24. For example, the blow-by gases may be exhausted through line 114 to line 118 in FIG. 1, between the manual and automatic throttle valve 48 and 50, respectively. Alternatively, the exhaust gases may be channeled to a crankcase venting system, such as disclosed in my U.S. Pat. No. 3,338,222. In the latter case, the line 114 would be connected to line 34 in my above referenced patent.

The guide member 76 is provided with two semi-circular openings 117; each opening being diametrically opposite the other, and penetrating the cylindrical portion 96 of the guide member 76. These openings 117 allow free admission of the wrist pin 84. Referring to FIG. 5; during assembling of the guide member 76, the piston 64, the connecting rod 66, the roller assembly 74 and the wrist pin 84; the piston 64 is placed head down upon a rest surface, causing thereby, the piston wrist pin bosses 82 to be uppermost. The guide member 76 is there passed downwardly over the piston until the base 98 portion of member 76, rest upon the wrist pin boss 82 end of the piston skirt 80. In this position the wrist pin boss holes 120 and the guide member 76 semi-circular openings 117 are aligned. The connecting rod 66 and the roller assembly 74 are then temporarily assembled by aid of an aligning pin temporarily serving as the wrist pin 84, and passed through the connecting rod and the roller. This temporary assembly is then brought inside the piston bosses 82, which are available as described above. The wrist pin 84, is then passed through the bosses 82 and the connecting rod 66, the roller assembly 74 and onward and through the second wrist pin boss and in so doing forcing out the aligning pin mentioned above. This forms a one piece assembly of the members shown in FIG. 5, which can then be readily assembled into the cylinder and retained by ring 110. The wrist pin 84 is retained in place by an interference fit of pin 84 and connecting rod boss.

As described above, the unique rolling crosshead assembly 72 shown in FIGS. 1 to 5 permits an increase in engine piston reciprocating speed above the known mechanical allowable limits of piston reciprocating (sliding) speed of current commercial automotive engines. The disclosed rolling crosshead 72, then, permits utilization of a lean (low power) fuel-air mixture, which results in clean pollution free, exhaust gases, since the increase in engine speed effected by the combination offsets the potential power loss resulting from the use of the lean fuel-air mixture.

The method of reducing hydrocarbon emissions from the exhaust of an internal combustion engine then includes supplying a fuel and air mixture of approximately one-half the normal engine requirement for full power output, from the carburetor 34 in FIG. 1, to the engine cylinder 24; increasing the engine rotational speed beyond the related known limits of piston reciprocating (sliding) speed, by utilization of the dual in-

duction system 22, to makeup the potential power lost to the lean mixture; guiding the reciprocating pistons 64 by utilizing the unique roller crosshead assembly 72 to eliminate the connecting rod forces upon the pistons and cylinders and permit the pistons to float within the cylinders, enabling the increased engine speeds; and, by means of the roller crosshead assembly 72, enable the combustion gases blown past the piston rings 86 to be collected within the cavity 119 formed by the piston rings 86 and the sealing ring 108, and drawn off through the port 116, to prevent the combustion gases blown past the piston rings 86, from reaching the crankcase 69 wherein to contaminate the engine lubricating oil and hinder obtaining the acceptable low level of unburned hydrocarbon emission possible to be obtained by this invention. Furthermore, the roller crosshead 72 feature of removing sliding loads on the pistons enables dry lubrication such as molybdenum disulfide to be applied to the cylinder 24 wall, the piston rings 86, the piston skirt 80, the sealing ring 108 and thereby lubricate these members without use of the normal engine lubricating oil, and thereby still further reducing unburned hydrocarbon exhaust emissions and bringing them to an absolute minimum, or even total elimination thereof. This method takes full advantage of the dual induction system disclosed in my above referenced U.S. Pat. No. 2,968,297, to achieve a substantially emission free exhaust.

The improved engine of this invention permits the reduction of the number of pistons 64 and cylinders 24, without a corresponding decrease in the engine power output for a specific number of cubic inches of piston displacement. This improvement is accomplished by increasing the engine speed, as described above, in combination with a shorter piston stroke. For example, a conventional engine might have a 4 inch diameter piston and a 4 inch stroke, providing approximately a 50 cubic inch displacement per cylinder. The preferred engine of this invention will operate efficiently with a 2 inch stroke, at twice the normal engine speed, providing the same piston displacement per minute of operation. This is accomplished by the utilization of the improved crosshead assembly 72 in combination with the dual induction system described above. The number of cylinders may now be decreased by increasing the diameter of the pistons. For example, if the diameter of the pistons of the engine described above are increased to 5.6 inches, the number of cylinders may be reduced by one-half without substantially reducing the power output of the engine. It must be remembered that this increase in engine speed is permitted by the configuration of the disclosed guide and piston assembly, in combination with the improved crosshead of this invention and would not be possible with a conventional engine configuration. The reduction of the number of cylinders by one-half, as described above, and doubling of the engine speed, results in the same number of impulses or firings per minute as a conventional engine with double the number of cylinders.

I claim:

1. An internal combustion engine, including at least one cylinder and a reciprocating piston for said cylinder, a multiple air induction means, air and fuel mixture inlet means, exhaust outlet means, said engine including a crank shaft operably connected to said piston by connecting means including a connecting rod, said induction means enabling said piston to be reciprocating

cated at speeds from zero up to at least 6,000 feet per minute, said induction means also including an unheated air intake means for supplying to said cylinder substantially all of the air inducted by said engine, and a heated intake means including a carburetor means, for supplying to said cylinder all of the engine's fuel requirements and a small percentage of said inducted air, said heated intake means including a heating means adapted to heat the inducted air and fuel, said carburetor means adapted to supply fuel to said cylinder to form in said cylinder an ignitable and thereafter self-burning gaseous mixture comprised of about 4 percent fuel, piston guiding means in the form of a roller cross head assembly adapted to float said piston axially within said cylinder and free said piston from said connecting rod's tendency to thrust said piston onto said cylinder and thereby preventing said connecting rod forces from bearing said piston on said cylinder and thereby limiting said piston speed whereby said engine's potential power output also becomes limited, said roller cross head assembly including a roller rotatably received by said connecting rod, said piston including a head portion and an annular skirt portion extending toward said connecting rod, a cup-shaped piston guide member opening toward said piston and receiving said piston skirt and a pair of opposed guideways rotatably receiving said roller and extending in the reciprocating axis of said piston, whereby said piston guiding means enables said induction system to be used to its full potential in said engine's power output, and whereby the maximum power loss for a given size piston displacement engine resulting from the lean fuel-air mixture supplied to said cylinder to substantially eliminate air polluting emissions is offset by the increased engine speed enabled by said piston guiding means instead of increasing said engine's piston displacement to recover said power loss.

2. The internal combustion engine defined in claim 1, characterized in that said piston guiding means includes said piston, and said connecting means, said cup-shaped piston guide member being adapted to be installed at each cylinder of said engine for guiding said connecting means and a wrist pin operably joining said piston and said connecting means within said guide member whereby said piston, said connecting means, said guide member and said wrist pin can be assembled as a unit and as a unit installable in each cylinder of said engine.

3. The internal combustion engine defined in claim 1, characterized by said roller being cylindrical and rotatably secured to said cross head by a wrist pin and thereby retaining said cross head and said piston in an assembled unit.

4. The internal combustion engine defined in claim 1, wherein said cup-shaped member is retained within said cylinder below the combustion area, said piston guiding means further including a sealing means biased against said pistons.

5. The internal combustion engine defined in claim 4, characterized in that said guideways extend toward said piston head within said piston skirt.

6. The internal combustion engine defined in claim 1, characterized in that only said piston head can engage the cylinder wall while said skirt portion clears the cylinder.

7. The internal combustion engine defined in claim 6, characterized in that each of said guide members

have a sealing means engaging said piston skirt portion and adapted to seal the space between said skirt portion and said guide member, whereby engine lubricating oil is substantially prevented from getting into said cylinder and said cylinder combustion gas blown by said piston is substantially prevented from getting into said engine's crankcase whereby engine air polluting emissions derived from fuel combustion and said lubricating oil becomes substantially eliminated from said engine and its exhaust.

8. The internal combustion engine defined in claim 1, characterized in that said guide member includes a guideway portion integral with said guide member and extending toward said piston head.

9. The internal combustion engine defined in claim 1, characterized in that said roller is generally cylindrical, has an axis of rotation perpendicular to the reciprocating axis of said piston and said roller including a plurality of small rollers known as needles within said roller's inside diameter and between said inside diameter and said wrist pin, to facilitate substantially frictionless rotation of said roller upon said wrist pin during said piston reciprocation.

10. The internal combustion engine defined in claim 1, characterized in that said crosshead means includes a fluid flow control means adapted to control the flow into said cylinders of said engine lubricating fluid from said engine's usual crankcase reservoir of said lubricating fluid, said fluid flow occurring during said engine operating occasions, said flow control means also adapted to conduct away from said cylinders the usual leakage of combusting gases, past said pistons, said flow control means includes a conventional piston ring operable disposed in said crosshead means and slidably engaging said piston whereby said engine lubricating fluid is kept out of said cylinders and whereby the exhaust emissions of unburned hydrocarbons as derived alone from said lubricating fluid exposure to the combustion portion of said cylinders, become thereby, substantially eliminated.

11. The internal combustion engine defined in claim 10, characterized in that said piston rings in the head of said piston and in said crosshead means are coated with one of the well known dry lubricants, namely molybdenum disulphide, for example, whereby the usual said lubricating fluid can be substantially eliminated from said piston rings and said cylinders, said cylinder surfaces engaged by said piston rings may be coated with said dry lubricant instead of said piston rings or both said cylinders and said piston rings may be so coated.

12. An internal combustion engine, including at least one cylinder and reciprocating piston for said cylinder, a multiple air induction means, air and fuel mixture inlet means, exhaust outlet means, said engine including a crank shaft operably connected to said piston by connecting means including a connecting rod, said piston having a skirt extending toward said crank shaft, said induction means enabling said piston to be reciprocated at speeds from zero up to at least 6,000 feet per minute, said induction means also including an unheated air intake means for supplying to said cylinder substantially all of the air inducted by said engine, and a heated intake means including a carburetor means for supplying to said cylinder all of the engine's fuel requirements and a small percentage of said inducted air, said heated intake means including a heating means

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adapted to heat the inducted air and fuel mixture, said carburetor means adapted to supply fuel to said cylinder to form in said cylinder an ignitable gaseous mixture comprised of about 4 percent fuel, piston guiding means including a roller cross head assembly adapted to float said piston axially within said cylinder and free said piston from said connecting rod's tendency to thrust said piston onto said cylinder, said piston guiding means including a pair of opposed guideways extending in the axis of said cylinder and in the axis of said piston reciprocating path, said guideways extending toward said piston head within said piston skirt, said piston guiding means further including a cup-shaped member retained within said cylinder below the combustion area and a sealing means biased against said piston, said crosshead forming a part of said connecting means and being received within said guideways, said crosshead

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assembly including a roller means at the connection between said connecting means and said piston, said roller means rotatably received within said guide ways, said guide ways including a linear channel extending in the axis of reciprocating movement of said piston and receiving said roller, whereby said piston guiding means enables said induction system to be used to its full potential in said engine's power output, and whereby the loss in maximum power for a given size piston displacement engine resulting from the lean fuel-air mixture supplied to said cylinder to substantially eliminate air polluting emissions is offset by the increased engine speed enabled by said piston guiding means instead of increasing said engine's piston displacement to recover said power loss.

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