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INTERNAL COMBUSTION ENGINE

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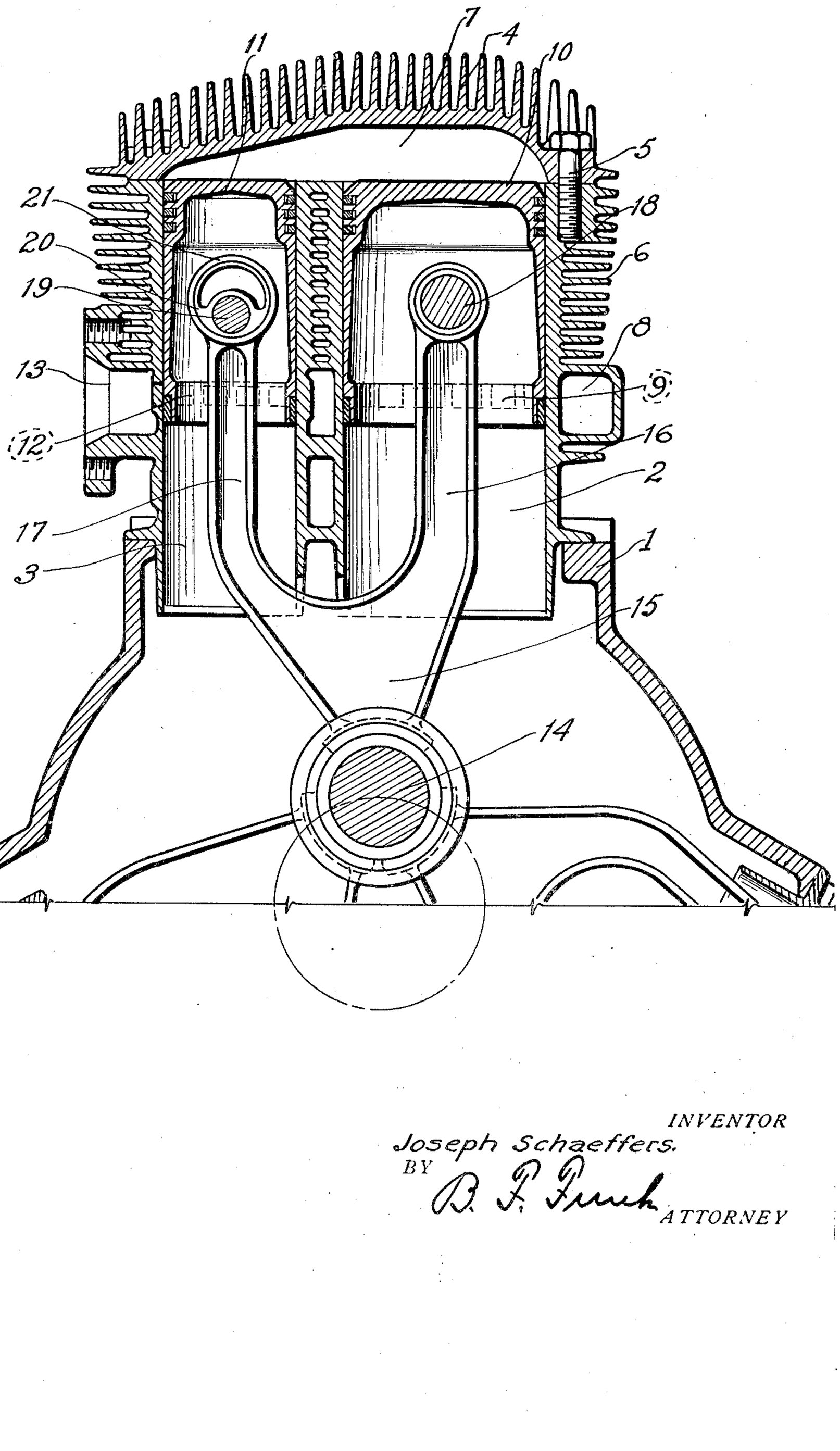

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UNITED STATES PATENT OFFICE

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INTERNAL-COMBUSTION ENGINE

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This invention relates to two cycle engines and particularly to a two cycle engine in which parallel cylinders are interconnected through a common space in the cylinder head, one of the cylinders having intake ports, the other exhaust ports and both cylinders containing pistons connected to the crank shaft by a single connecting rod.

It is generally admitted that the only way of obtaining an efficient two cycle carburetor engine is by means of the double piston cylinder. This may be either a set of opposed pistons working in one cylinder or a pair of pistons working side by side in a double cylinder with one single combustion chamber, this type of cylinder usually being called a U-cylinder.

For Diesel or semi-Diesel engines single piston designs can be used successfully, but whenever a carbureted mixture is charged into the cylinder the above described double piston types are now considered the most successful.

Two cycle U-cylinder engines can be operated on crank case compression, but where a wide range of speeds or high volumetric efficiency is desired, a blower of the vane or "Roots" type is employed. This is absolutely necessary in engines of the radial type, since they do not give any crank case compression at all.

The blower used for charging the cylinder or cylinders with a carbureted mixture consumes a certain amount of power, depending for a given volume of charge upon the delivery pressure of the charge. But this pressure not only causes a rapid increase in power required to produce it, but it likewise causes a rapid increase in temperature of the charge, decreasing thereby its weight per volume and reducing to that proportion the volumetric efficiency of the motor. It is therefore desirable to hold the blower pressure as low as possible, and the purpose of this present design is a U-cylinder arrangement enabling the highest possible volumetric efficiency combined with a very low blower pressure. This result is obtained by making the two cylinders of the U of materially different diameters, so that the piston area of the intake cylinder is a multiple of that of the piston in the exhaust cylinder. Of course, the result is a cutting down of the effective size of the exhaust ports; but the exhaust pressure is in the neighborhood of forty pounds and a relatively very small exhaust port enables a complete discharge provided the port is uncovered sufficiently ahead of the intake port.

The drawing illustrates an engine design in which the intake piston has about two and one-half times the area of the exhaust piston. For the intake ports, the entire circumference of the large cylinder is available, enabling a rapid filling with low pressure and correspondingly low gas velocity. Of course, in the conventional U-cylinder, the entire circumference is likewise available for intake ports, but in the conventional type the volume of the intake cylinder is only one-half of the piston displacement and the incoming charge has to fill not only the intake cylinder but one hundred per cent more for the exhaust cylinder, so that the intake ports are really not any larger than if only half the circumference were available in a single piston cylinder of the same diameter.

But in the design as herewith illustrated, the volume of the intake cylinder is only increased by forty per cent for the volume of the exhaust cylinder; the combustion space requirements of course being on the same proportionate basis.

An incidental advantage is the possibility to give the exhaust cylinder a much greater offset from the center line of the engine, than otherwise practical, without disturbing the pressure balance on the connecting rod or unduly increasing the side pressure on the pistons, and as a result a wide variation in timing becomes available for the various purposes for which the motor may be used. For example, one timing may be arranged for maximum economy and moderately high power output, while another timing may be provided for maximum power output with moderate economy. But the essential advantage is first and last, a higher volumetric efficiency than in a U-cylinder having the same bore for both cylinders.

Another detail of construction in this

U-cylinder design is the eccentric bushing on the exhaust piston pin. So far it has been customary to provide a slide block for the piston pin in one of the pistons of a U-cylinder engine, which has not proved very satisfactory. Most designers have therefore gone lately to the use of a link rod for one piston, hinging same with a link pin to the connecting rod of the other piston, which increases the number and weight of parts and of bearing surfaces that have to be oiled, making the positive lubrication of the piston pin in the hinged piston extremely difficult. The eccentric bushing can be lubricated the same way as a concentric bushing would have to be, but the eccentric bushing oscillates slightly to take care of the sine of the arc described by one lug of the connecting rod around the fixed center of the intake piston pin and while going through the right angle position with the crank shaft on both up and down strokes.

The drawing illustrates a vertical, longitudinal, sectional view through two communicating cylinders with pistons therein, a connecting rod for connecting the two pistons to a crank shaft being shown in elevation.

The crank case 1 is illustrated supporting two parallel cylinders 2 and 3 having a common head 4 which may be bolted or otherwise secured to the cylinder unit by fastening devices 5. The cylinders and head are preferably provided with vanes or projections 6 which carry off the heat from the cylinders in a well understood manner so the engine can be air cool. The head 4 incloses a common combustion space 7 above the two cylinders so that fuel supplied from the manifold 8 may pass through the inlet ports 9 into the space above the piston 10 and upon being combusted in the space 7 will exert pressure against the piston 10 and piston 11 in the cylinder 3 which is provided with exhaust ports 12 discharging into the exhaust manifold 13.

It will be noted that the intake cylinder, as well as the piston 10, is of greater cross-section than the cylinder 3 and the piston 11. As shown, the cross-sectional area of the intake cylinder and its piston is about two and one-half times greater than the cross-sectional area of the cylinder 3 and its piston and that inasmuch as the intake ports 9 extend substantially entirely around the circumference of the cylinder 2, there may be a rapid filling of the cylinder 2 of fuel at low pressure with corresponding low gas velocity, this being a material advantage over the conventional type of so-called U-cylinder in which the intake cylinder is only one-half of the piston displacement and the incoming charge not only has to fill the intake cylinder but also the exhaust cylinder. The relatively small exhaust ports and the pressure (about forty pounds) at which the burnt gas is discharged insures a complete discharge provided the exhaust ports are uncovered in advance of the intake ports.

I have provided a novel arrangement for connecting the pistons to the crank of the crank shaft. The crank 14 will have sufficient throw to effectually move the pistons 10 and 11 to uncover the respective ports. The crank carries a U-shaped connecting rod 15 having spaced arms 16 and 17. The arm 16 is connected to the piston 10 by the usual wrist pin 18. The arm 17 is connected to the wrist pin 19 by an eccentric connection consisting of the eccentric 20 on the wrist pin and the collar 21 in which the eccentric rotates. By reference to the drawing, it will be observed that the eccentric bushing consisting of the members 20 and 21 oscillates slightly to take care of the sine of the arc described by the arm 17 of the connecting rod around the fixed center of the piston pin or wrist pin 18 while traversing the right angle position with the crank shaft on both up and down strokes. This is a material improvement over the slide block connection sometimes employed where two pistons are in parallel.

An inspection of the drawing will indicate that as the crank shaft rotates, the piston 11 will uncover the exhaust ports in advance of the intake ports and that inasmuch as the gas enters the intake ports at low pressure and low velocity, effective scavenging can be accomplished. The single unitary structure illustrated may be multiplied for any type of engine, as designed. it is adapted for a radial three unit type of internal combustion engine but, obviously, I do not wish to be limited to the particular type of motor shown.

An incidental advantage of the material difference in cylinder diameter is the fact that the exhaust cylinder, being of the smaller diameter, but having the same number of cooling fins, thereby possesses a greater cooling surface per cubic inch of volume than the intake cylinder. This difference in the area of the cooling surface offsets the temperature differences between the two cylinders and prevents warping, which is often found in air cooled U-cylinders having like cylinder diameters.

What I claim and desire to secure by Letters Patent is:—

1. An internal combustion engine comprising a pair of open cylinders, one of which is of greater diameter than the other, a head providing a combustion chamber common to both cylinders, pistons in the cylinders, a crank shaft, a forked connecting rod connected to the crank shaft, a connection between one arm of the crank shaft and the piston in the larger cylinder and an eccentric connection between the other arm of the connecting rod and the piston in the other cylinder.

2. An internal combustion engine compris-

ing two cylinders in open communication at their ends, one of the cylinders having an inlet port and the other an exhaust port, pistons in the cylinders, a forked connecting rod, a concentric connection between one arm of the forked connecting rod and one of the pistons and an eccentric connection between the other arm of the connecting rod and the remaining piston.

In testimony whereof I affix my signature.

JOSEPH SCHAEFFERS.