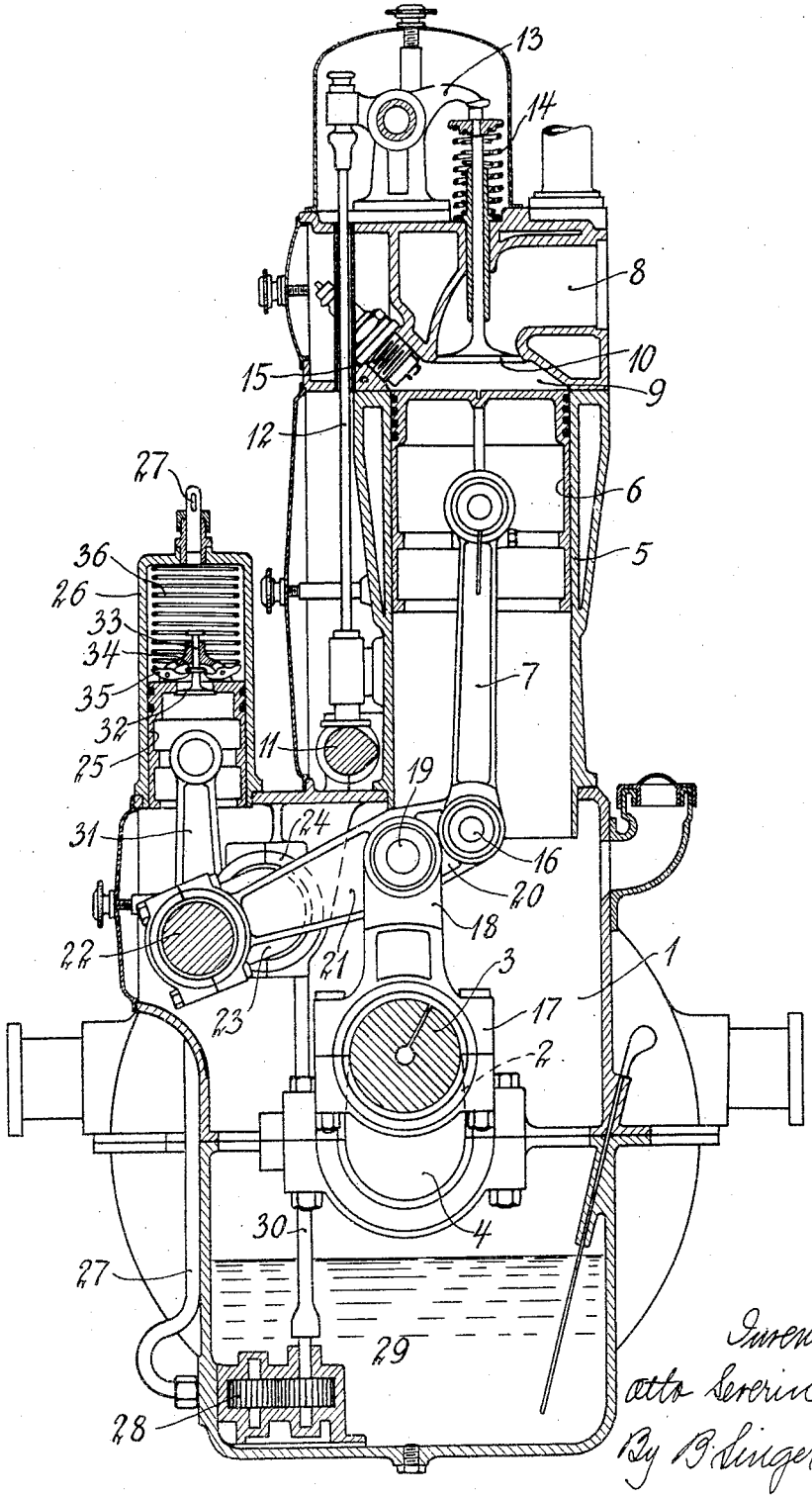
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INTERNAL COMBUSTION ENGINE

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INTERNAL COMBUSTION ENGINE

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In the ordinary construction of internal-combustion engines the compression space (i. e. the volume of the cylinder above the piston in its top position) has a constant size. However, as the amount of combustible mixture received by the cylinder varies with the load and is less at small loads than at high loads, the compression pressure will be unproportionately low at small loads. This also applies to the combustion pressure. The energy diagram will be too low at the minor loads, and only at full load the motor operates normally, economically and with a complete combustion. This inconvenience is noticeable particularly in autocar motors, because the latter operate completely loaded only during a small percentage of the time of operation.

Therefore, it has been proposed to so vary the size of the motor space with the load that it increases and decreases with same, a movable piston being arranged at the cylinder top and forming a portion of the walls of the compression space or of the top head and yielding the more the load rises, consequently increasing the compression space correspondingly.

According to the present invention a variable compression space is brought about by means of a movable connection between the piston and the crank pin, and this connection is under the control of a resistance member, whose resistance adjusts itself automatically according to the load. As a resistance preferably an oil brake is used.

The said movable connection may be of different kind. It may be arranged in the pitman rod itself but more suitably a lever transmission is used between the pitman rod, the crank pin and the resistance.

An embodiment is illustrated in the accompanying drawing showing a vertical section through the motor.

In the crank housing 1 the crank 2 with crank pin 3 are arranged as usually on the shaft 4, and in the power cylinder 5 the piston 6 is reciprocated by the pitman rod 7. The inlet 8 to the compression space 9 is controlled as usually by a valve 10 from the controlling shaft 11 through trust rod 12, lever 13 and spring 14. A similar valve device controls the outlet (not shown). 15 is the spark plug.

According to the invention there is arranged between crank pin 3 and piston 6 an adjustable connection. For instance between the lower pin 16 of pitman 7 and pin 3 a leverage is arranged. The pin 3 is surrounded by bearing 17 on the bottom end of a rod 18 having its top pin 19 connected between the ends with a double lever 20, 21. The latter forms an unequal-armed lever, whose short arm 20 is located between pins 16 and 19 and the long arm 21 between pin 19 and a pin 22 which forms a crank of a rocking arm 23 journaled at 24. Further, pin 22 is through a piston rod 31 connected with a piston 25 in an oil cylinder 26 having its top connected through a pipe 27 with an oil pressure pump 28 (for instance a tooth-wheel pump) which is immersed in oil 29 in the bottom of crank housing 1 and which is driven by shaft 30 from the motor in any suitable manner (not shown), so that the oil quantity conveyed to the top of cylinder 26 depends upon the motor speed, and the oil circulation is maintained as long as the motor runs. The bottom of piston 25 has a valve 32 controlling the passage of oil from top of cylinder 26 through the piston back to the crank housing. The rod 33 of said valve has a collar 34, under which project the inner ends of levers 35 pivotally supported by piston 25 and whose outer ends are loaded by a common spring 36 in the top space of cylinder 26.

The operation is as follows:

Assuming the engine is in normal operation, a continuous stream of oil passes from top of oil cylinder 26 down through valve 32 of piston 25, the passage area of said valve adjusting itself automatically. The spring 36 tends to close the valve and also to press down piston 25, whereas the oil pressure in top space of cylinder 26 tends to open the valve and also exerts a force downwards upon the piston. The upper pin of pitman 31 consequently meets in piston 25 a yielding resistance, whose size depends upon the oil pressure and the tension of spring 36.

If now the working piston 6 is moving upwards to compress the explosive charge, the degree of compression will depend upon the momentary resistance of oil piston 25.

If the resistance is great it will permit the crank pin 3 to transmit to piston 6 a great force through the divided pitman 18, 19, 20, 16, 7.

During the succeeding explosion the pressure may be so high that the resistance piston 26 yields, whereby the working piston 6 takes a correspondingly lower top position during its next upward stroke. This determines the size of the compression space 9 for the next explosion. Said space remains unaltered under one and the same load.

If now more gas is given to the motor, the combustion pressure in space 9 raises and overcomes still a part of the resistance in piston 25. The latter is displaced further upwards, whereby lever 20, 21 swings through a small angle in clockwise direction, and the distance between piston 6 and crank pin 3 is correspondingly decreased, consequently space 9 is increased. The closing pressure of valve 32 is also increased, because spring 36 is more compressed, whereby the resistance in piston 26 as a whole is increased. Therefore the parts adjust themselves according to the new load.

The arrangements results in a more complete combustion of the gas mixture. At the starting moment proper the piston 25 may take its uppermost position, but soonly after it will adjust itself according to the load. The starting of the motor is thereby facilitated.

It will also be seen that a definite resistance and position of oil piston 25 will correspond to any compression or explosion, pressure in combination with the gearing of the motor, and by a suitable sizing of the parts a high economy may be obtained at small as well as large gas supply to the motor.

Obviously the construction may be altered in various manners within the scope of the invention. It may be utilized in two-cycle, four-cycle and high-cycle motors.

I claim:

1. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a yieldable resistance controlling the position of said leverage and thereby the operative length of the pitman.

2. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a liquid resistance controlling the position of said leverage and thereby the operative length of the pitman.

3. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a liquid resistance controlling the position of said leverage and thereby the operative length of the pitman, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, a variable spring load of the valve, and means for continuously supplying oil under pressure to the oil cylinder.

4. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a liquid resistance controlling the position of said leverage and thereby the operative length of the pitman, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, a variable spring load of the valve, a pump for continuously supplying oil under pressure to the oil cylinder, and means for operating the pump from the engine.

5. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a liquid resistance controlling the position of said leverage and thereby the operative length of the pitman, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, a variable spring load of the valve, and means for continuously supplying oil under pressure to the oil cylinder, the variation in the spring load of the valve being caused by the movement of the oil piston as a consequence of the variation in the compression or combustion pressure.

6. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a liquid resistance controlling the position of said leverage and thereby the operative length of the pitman, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last-named piston, a variable spring load of the valve, and means for continuously supplying oil under pressure to the oil cylinder, the valve loading spring acting simultaneously as a yielding resistance for the oil piston.

7. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a liquid resistance controlling the position of said leverage and thereby the operative length of the pitman, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last

named piston, levers mounted in the piston and adapted to yieldingly close the valve, a load spring pressing with one end on the oil cylinder head and with the other end upon the load levers to close the valve and simultaneously to increase the oil pressure resistance of the oil piston and means for continuously supplying oil under pressure to the oil cylinder.

8. In an internal combustion engine, the combination of a working piston, a crank pin, a pitman rod made in two parts, a leverage connecting the pitman parts together, and a liquid resistance controlling the position of said leverage and thereby the operative length of the pitman, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, levers mounted in the piston and adapted to yieldingly close the valve, a load spring pressing with one end on the oil cylinder head and with the other end upon the load levers to close the valve and simultaneously to increase the oil pressure resistance of the oil piston, a pump for continuously supplying oil under pressure to the oil cylinder, and means for operating the pump from the engine.

9. In an internal combustion engine, the combination of a working piston, a crank pin, a connection between said piston and pin, and a liquid resistance inserted in said connection, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, a variable spring load of the valve, and means for continuously supplying oil under pressure to the oil cylinder.

10. In an internal combustion engine, the combination of a working piston, a crank pin, a connection between said piston and pin, and a liquid resistance inserted in said connection, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, a variable spring load of the valve, a pump for continuously supplying oil under pressure to the oil cylinder, and means for operating the pump from the engine.

11. In an internal combustion engine, the combination of a working piston, a crank pin, a connection between said piston and pin, and a liquid resistance inserted in said connection, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, a variable spring load of the valve, and means for continuously supplying oil under pressure to the oil cylinder, the variation in the spring load of the valve being caused by the movement of the oil piston as a consequence of the variation in the compression or combustion pressure.

12. In an internal combustion engine, the combination of a working piston, a crank pin, a connection between said piston and pin, and a liquid resistance inserted in said connection, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, a variable spring load of the valve and means for continuously supplying oil under pressure to the oil cylinder, the valve loading spring acting simultaneously as a yielding resistance for the oil piston.

13. In an internal combustion engine, the combination of a working piston, a crank pin, a connection between said piston and pin, and a liquid resistance inserted in said connection, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, levers mounted in the piston and adapted to yieldingly close the valve, a load spring pressing with one end on the oil cylinder head and with the other end upon the load levers to close the valve and simultaneously to increase the oil pressure resistance of the oil piston and means for continuously supplying oil under pressure to the oil cylinder.

14. In an internal combustion engine, the combination of a working piston, a crank pin, a connection between said piston and pin, and a liquid resistance inserted in said connection, said liquid resistance comprising an oil cylinder, a piston therein, an oil passage valve in the last named piston, levers mounted in the piston and adapted to yieldingly close the valve, a load spring pressing with one end on the oil cylinder head and with the other end upon the load levers to close the valve and simultaneously to increase the oil pressure resistance of the oil piston and a pump for continuously supplying oil under pressure to the oil cylinder, and means for operating the pump from the engine.

In testimony whereof I have signed my name to this specification.

OTTO SEVERIN RUUD.