

April 10, 1928.

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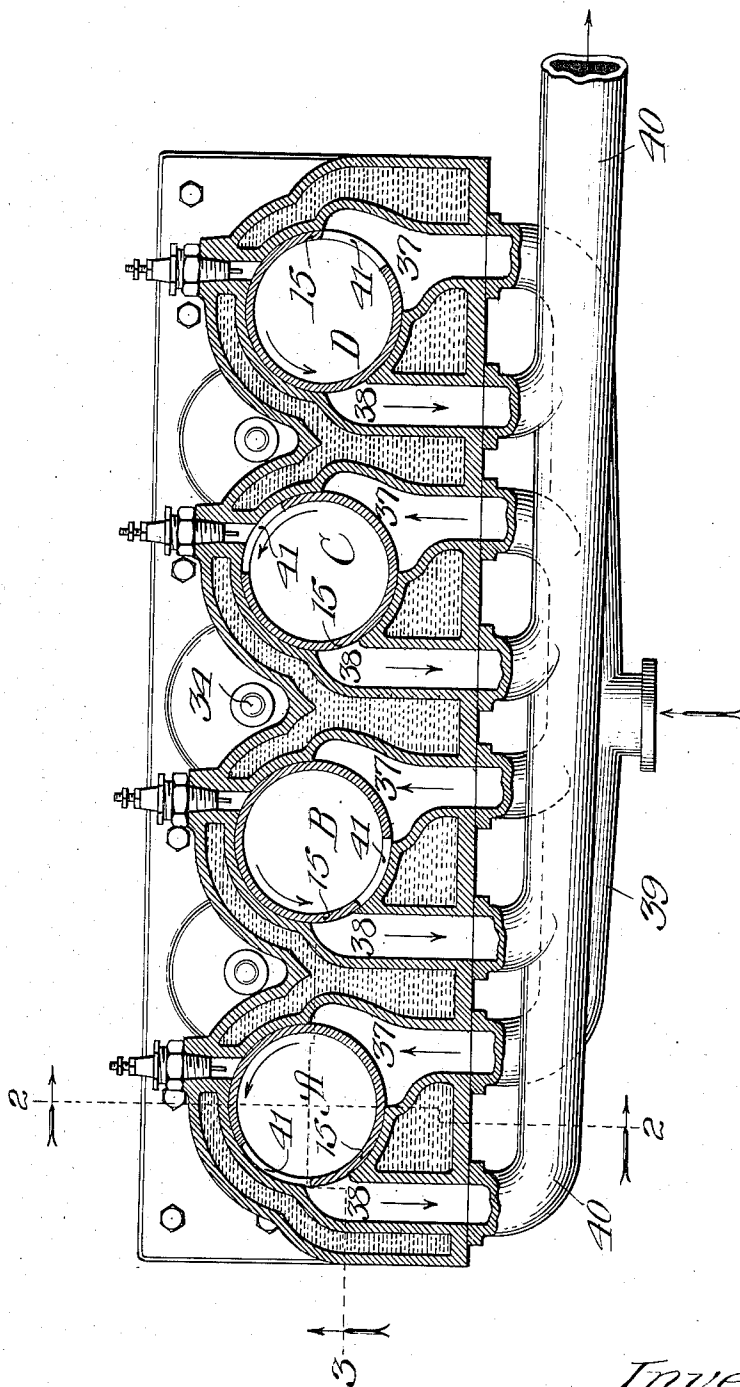
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INTERNAL COMBUSTION ENGINE

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5 Sheets-Sheet 1

Fig. 1.



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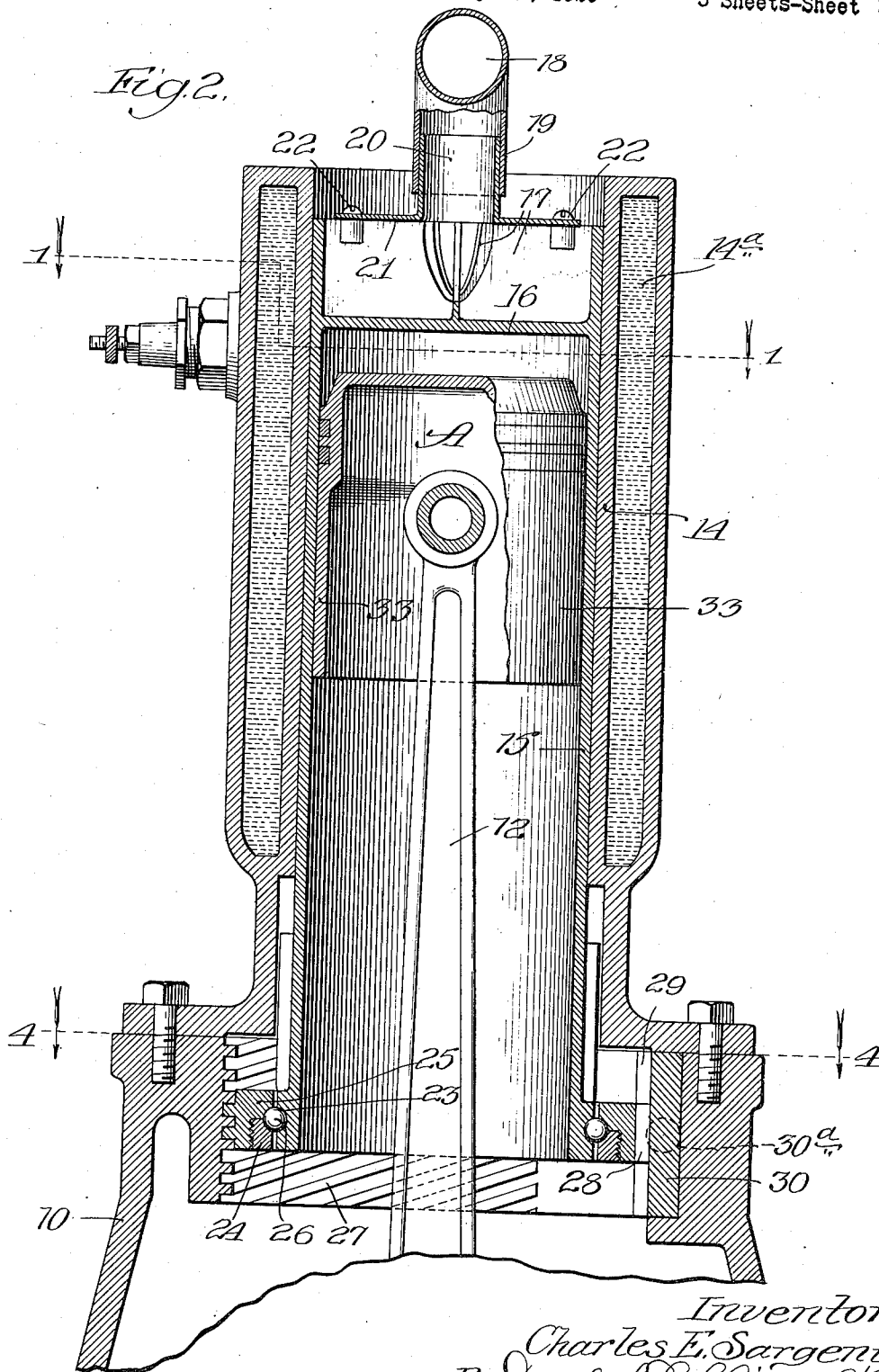
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INTERNAL COMBUSTION ENGINE

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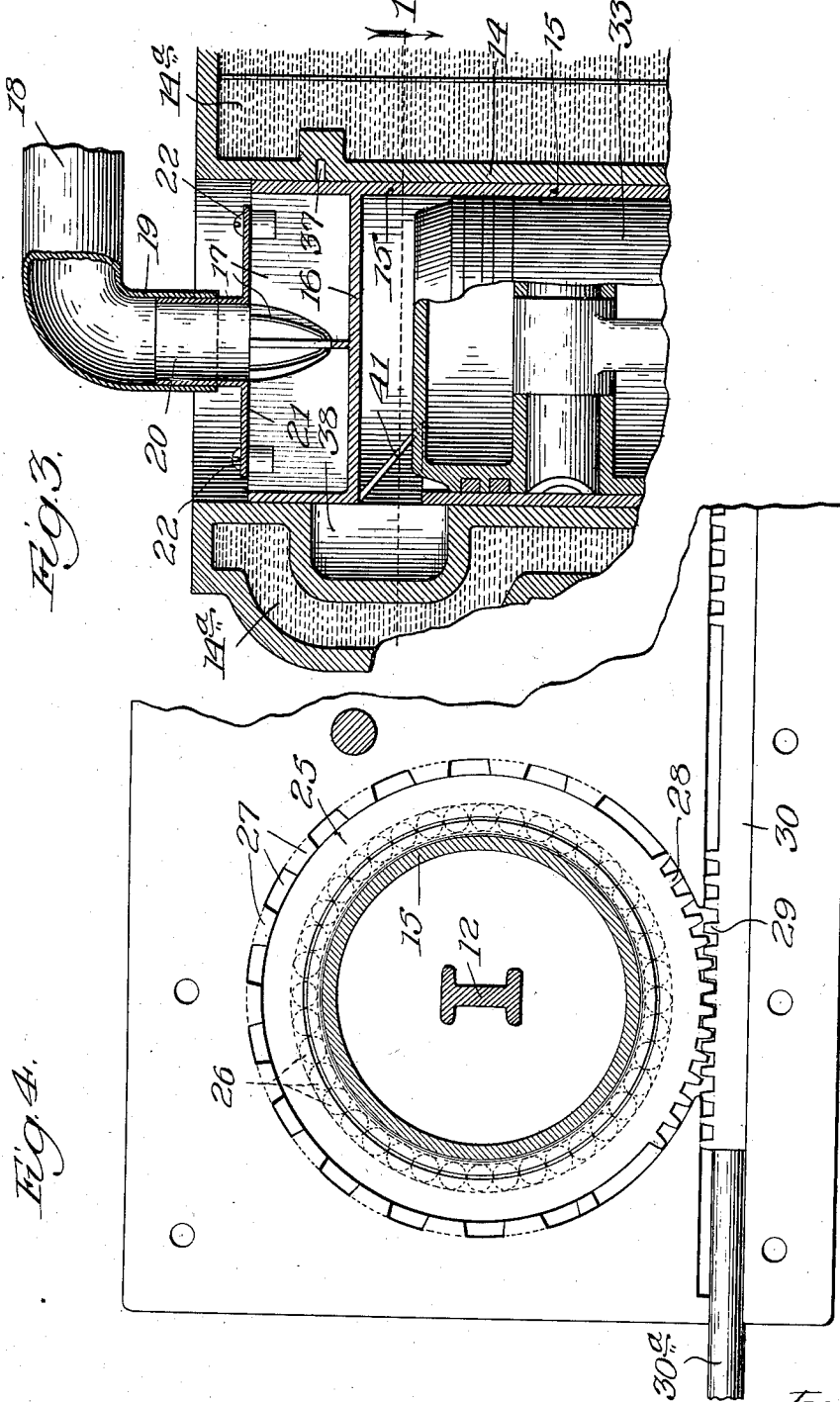
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INTERNAL COMBUSTION ENGINE

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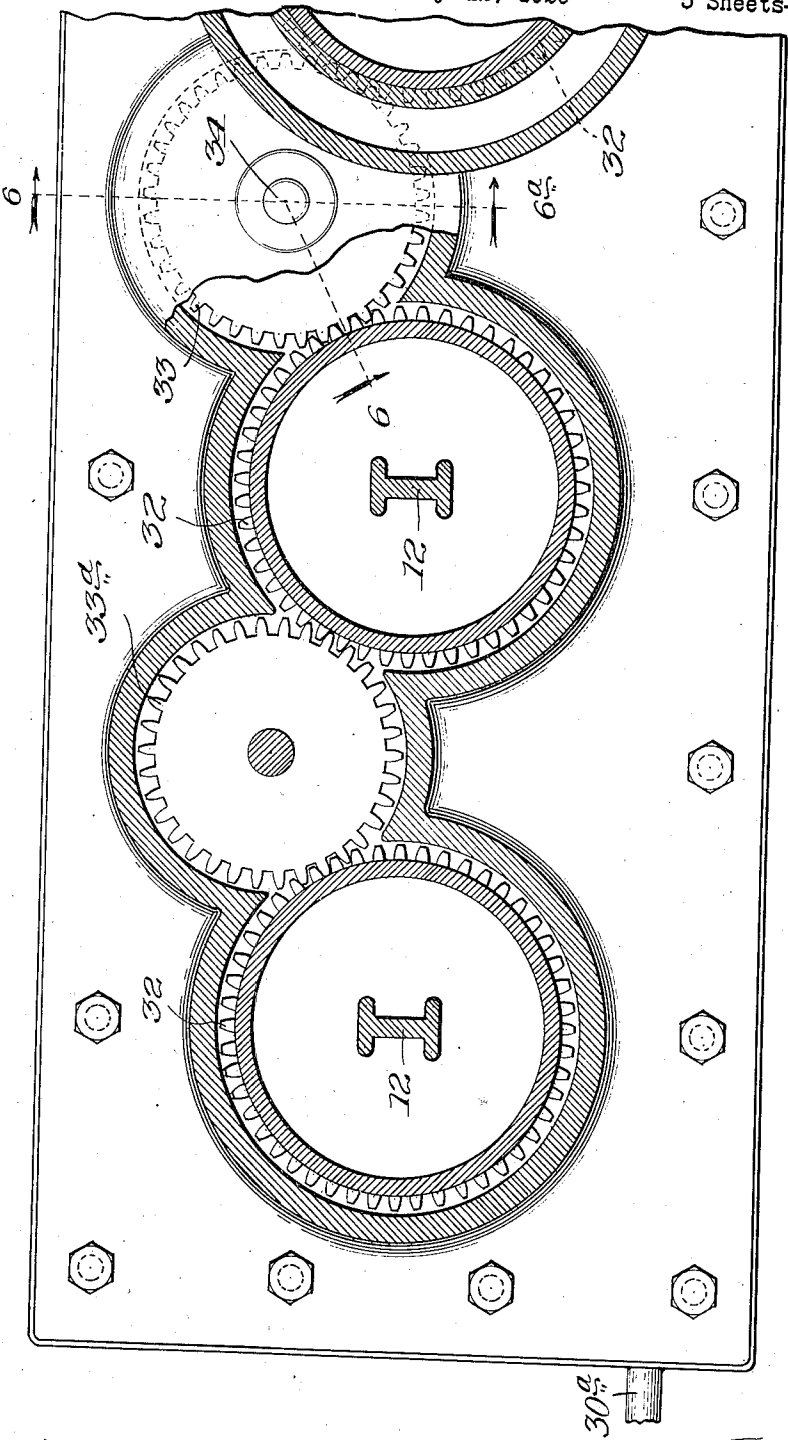
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INTERNAL COMBUSTION ENGINE

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5 Sheets-Sheet 4



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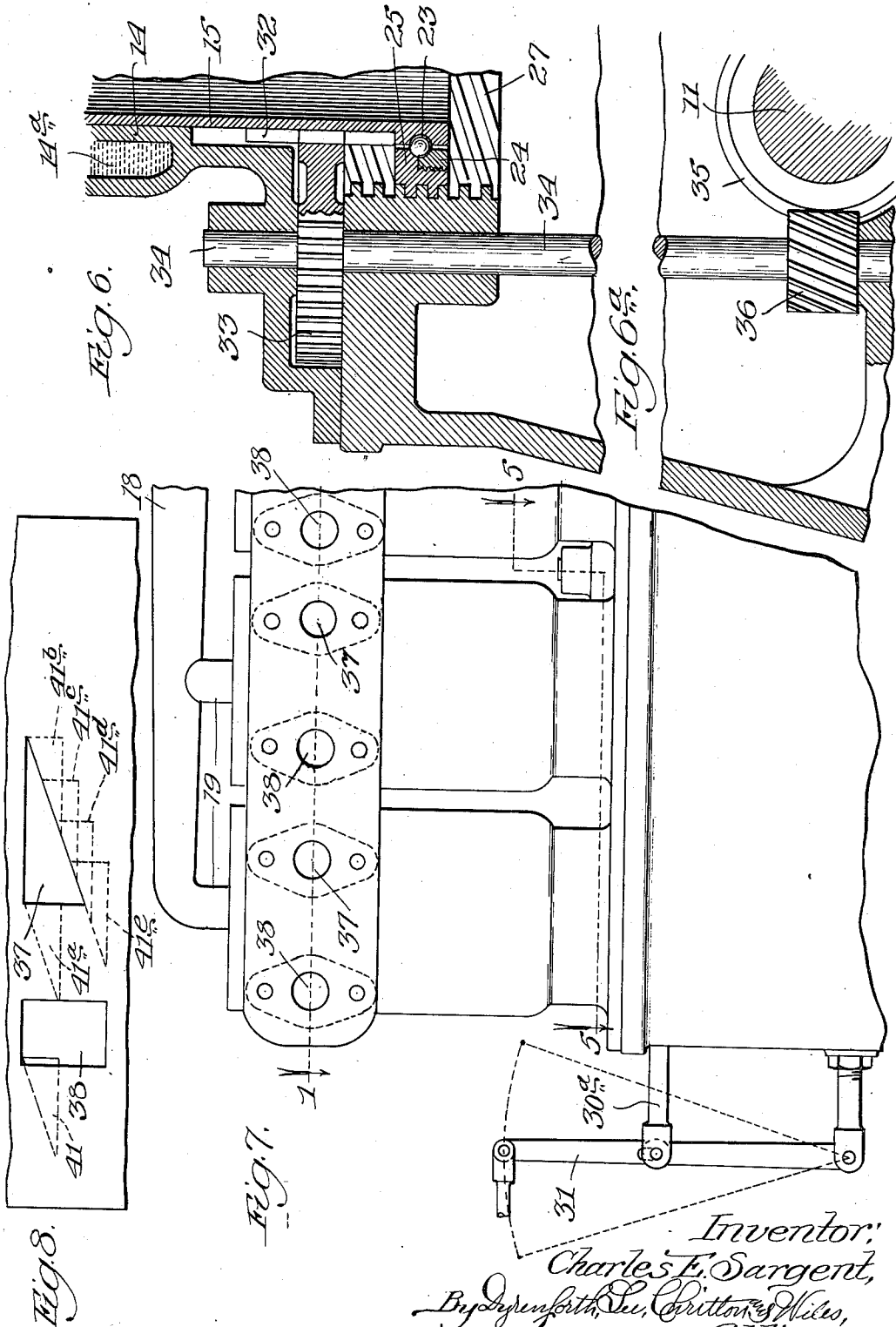
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INTERNAL COMBUSTION ENGINE

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

Application filed July 12, 1926. Serial No. 121,837.

This invention relates to internal combustion engines and more particularly to such as belong to the well-known sleeve valve type. The invention is fully described in the following specification and shown in the accompanying drawings, in which:

Figure 1 is a horizontal longitudinal section through the engine on the line 1—1 of Figs. 2 and 7;

Fig. 2 is a transverse vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a partial vertical section on the line 3 of Fig. 1;

Fig. 4 is a partial horizontal section on the line 4—4 of Fig. 2;

Fig. 5 is a partial horizontal section on the broken line 5—5 of Fig. 7;

Fig. 6 is a partial vertical section on the broken line 6—6 of Fig. 5;

Fig. 6^a is a similar section on the line 6^a of Fig. 5;

Fig. 7 is a partial side elevation of the engine showing the intake and exhaust manifolds removed; and

Fig. 8 is a developed view of the upper portion of the cylinder showing the relative positions of the intake and exhaust manifolds.

The embodiment illustrated comprises an internal combustion engine which is here illustrated as having four cylinders, but it will be understood that this is illustrative only and that it may readily be adapted to be used on other numbers and arrangement of cylinders. The engine has the usual crank case 10, crank-shaft 11 (Fig. 6^a), connecting rod 12, piston 13 and cylinder 14.

Between the piston 13 and cylinder 14 is a sleeve 15 which is closed at its upper end by means of a head 16 which is preferably made integral therewith and has a series of fins 17. These are air cooled by means of air which is carried thereto through the air manifold 18 which has a vertical extension 19 over each cylinder head which surrounds a tube 20, the latter having a flange 21 which is secured to the fins 17 by means of the screws 22. Air sucked through by centrifugal force due to the revolving fins 17, or forced through the air manifold 18 from a fan (not shown) passes between the fins 17 and around the outer edges of the flange 21. The cylinders 14 are cooled in any desired manner as by means of water jackets 14^a.

The lower end of the sleeve 15 is provided

with an annular ball race 23, the complementary ball race 24 being carried by a nut 25 while a series of balls 26 operate between these ball races.

Thus it will be seen that the sleeve 15 is free to turn within the cylinder 14, while its height is regulated by means of the nut 25. This nut has a series of spiral threads which engage the threads 27 of the crank-case 10. This nut turns only through part of a revolution, and carries an interrupted spur gear 28 which meshes with a sectional rack 29 which is carried by the rack bar 30 which extends along all the cylinders and has a similar rack engaging a similar nut for controlling the position of the sleeve of each cylinder so that all of them raise and lower simultaneously and by equal amounts. The rack bar 3 has a extension 30^a which is pivotally connected to a lever 31 or similar device which is under the control of the operator, so that by moving it back and forth he is able to control the height of the sleeves 15 for a purpose which will be hereinafter explained. The spiral threads pass through the spur gear teeth 28 but, for the sake of clearness, they are not so shown.

The several sleeves 15 are simultaneously and equally rotated in the same direction by means of gear teeth 32 formed on the lower ends of their outer surfaces and the two middle sleeves mesh as shown in Fig. 6 with a pinion 33 which is keyed on a shaft 34 which is driven by the crank-shaft 11 (Fig. 6^a) through spiral gears 35, 36. This bearing is so timed that the sleeves 15 rotate at one-half engine speed. The end sleeves are driven by idlers 33^a which mesh with the gear teeth on the middle sleeves.

Each cylinder is provided with an intake port 37 and has an exhaust port 38 which are connected to intake and exhaust manifolds 39 and 40 respectively. At 41 (Fig. 8) is shown the dotted outline of the port or opening in the sleeve 15. As the sleeve 15 is rotated, the opening 41 will advance in the directions of the arrows, assuming the position 41^a where the inlet port is just opening and later that of 41^b where this port is just closing, and it will then continue to rotate until it again assumes the position 41 where the exhaust port is open part way.

In the positions 41, 41^a and 41^b, the sleeve 15 is at its maximum height, with the result that the inlet port remains open throughout the entire intake stroke. The closing posi-

tion 41^b being arranged to close at or near the end of this intake stroke.

As the sleeve 15 is lowered, however, the opening in the sleeve 15 will assume the positions 41^c, 41^d, and 41^e which represent substantially three-quarters, one-half, and one-quarter cut off for the inlet port. This is due to the beveled or diagonal cut of the last engaging edges of the port 37 on the one hand and the opening 41 on the other. Since the inlet port 37 corresponds to substantially the entire 90° movement of the crankshaft, which is the intake stroke, it is clear from the four outlined positions of the sleeve opening 41 in Fig. 8 that the inlet port closes earlier and earlier as the sleeve 15 is lowered.

At the same time, it will be noted that the head 16 is correspondingly lowered, so that as the cut-off becomes earlier and earlier, the clearance space between the cylinder head and the top of the piston becomes less and less with the result that an equally constant final compression pressure is obtained for all positions of the sleeve 15.

While I have shown and described but a single embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, may be made in the construction and arrangement which do not depart from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. In an internal combustion engine, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, a piston slidable in said sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, and means for moving said sleeve longitudinally to control the operation of said engine.

2. In an internal combustion engine, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, a piston slidable in said sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve and means for moving said sleeve longitudinally to vary the cut-off of said engine.

3. In an internal combustion engine, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, a piston slidable in said sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, and means for moving said sleeve longitudinally to control the operation of said engine, said head being firmly secured to said sleeve so as to vary the clearance volume with the longitudinal movement of said sleeve.

4. In an internal combustion engine, a cyl-

inder, a sleeve rotatable therein, a head in said rotatable sleeve, a piston slidable in said sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, and means for moving said sleeve longitudinally to vary the cut-off of said engine, said head being firmly secured to said sleeve so as to vary the clearance volume with the longitudinal movement of said sleeve, the clearance volume decreasing as the cut-off is decreased so as to maintain substantially constant compression pressures with varying points of cut-off.

5. In an internal combustion engine, a crank-case, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, a piston slidable in said sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, a nut rotatably mounted on said sleeve, spiral threads on said nut, spiral threads in said crank-case engaging the threads of said nut, and means for turning said nut to move said sleeve longitudinally of the cylinder.

6. In an internal combustion engine, a crank-case a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, a piston slidable in said sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, a nut rotatably mounted on said sleeve, spiral threads on said nut, spiral threads in said crank-case engaging the threads of said nut and a rack geared to said nut for turning said nut to move said sleeve longitudinally of the cylinder.

7. In an internal combustion engine, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, a piston slidable in said sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, a nut rotatably mounted on said sleeve, spiral threads partially surrounding the periphery of said nut, gear teeth on part of said periphery, and a rack meshing with said gear teeth and movable endwise to move said sleeve longitudinally of the cylinder.

8. In an internal combustion engine, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, means for moving said sleeve longitudinally to control the operation of said engine, fins on said head and means for directing a current of air on said fins for cooling the head.

9. In an internal combustion engine, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and

in said sleeve, means for moving said sleeve longitudinally to control the operation of said engine, the closing sides of the port in the sleeve and the inlet port in the cylinder being diagonally cut so as to cause the inlet port to close earlier as the sleeve is lowered. 15

10. In an internal combustion engine, a cylinder, a sleeve rotatable therein, a head in said rotatable sleeve, means for rotating said sleeve in timed rotation to the engine shaft, inlet and outlet ports in said cylinder and in said sleeve, means for moving said sleeve longitudinally to control the operation of said engine, the closing sides of the port in the sleeve and the inlet port in the cylinder being diagonally cut so as to cause the inlet port to close earlier as the sleeve is lowered, said port in the sleeve extending below the lowermost edge of the inlet port in the cylinder. 20

In testimony whereof I have hereunto set my hand this 25th day of June, A. D., 1926.

CHARLES E. SARGENT.