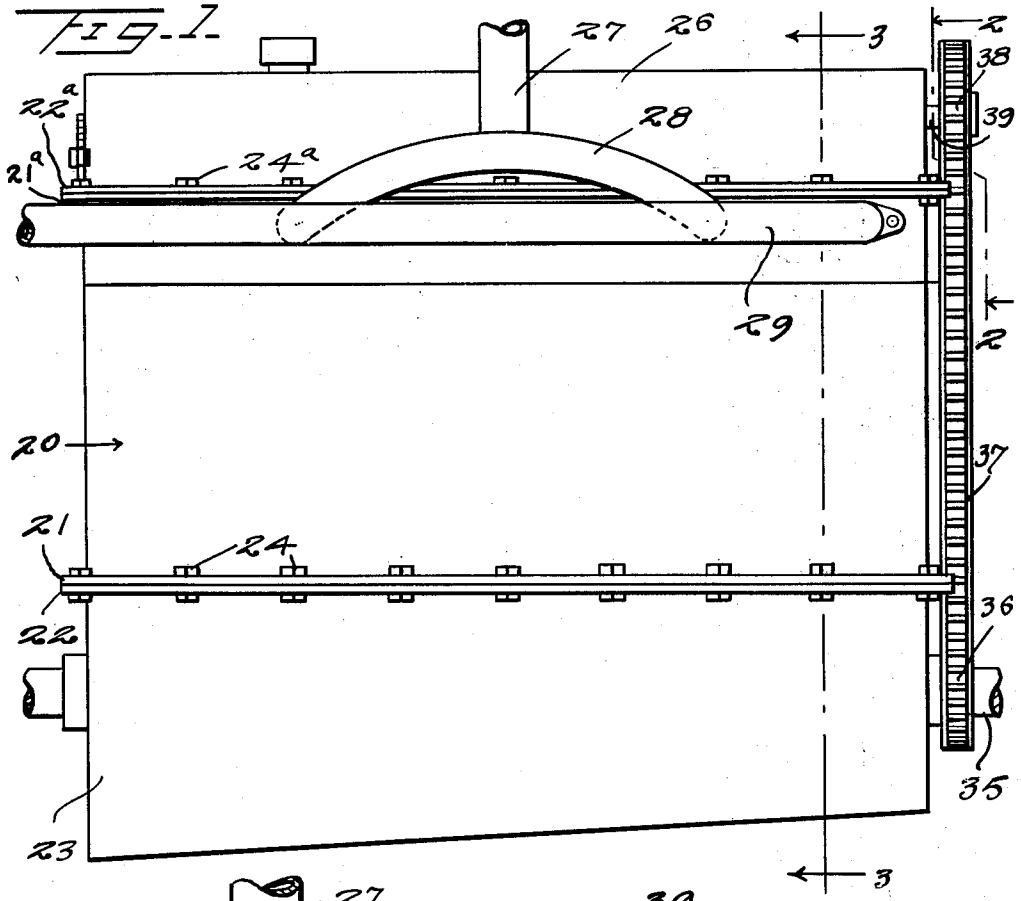
April 20, 1954 F. J. ARISMAN 2,676,061

FUEL INJECTOR FOR INTERNAL-COMBUSTION ENGINES

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Fig. 1



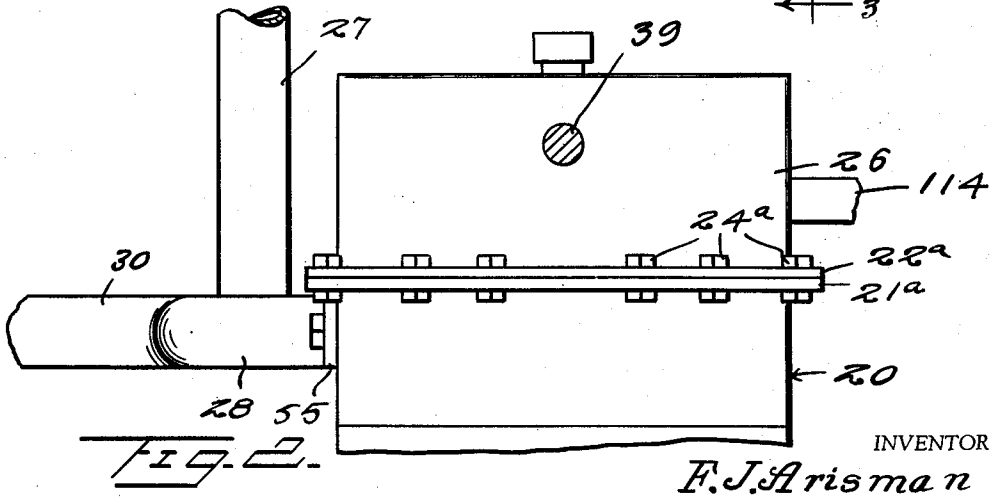


Fig. 2

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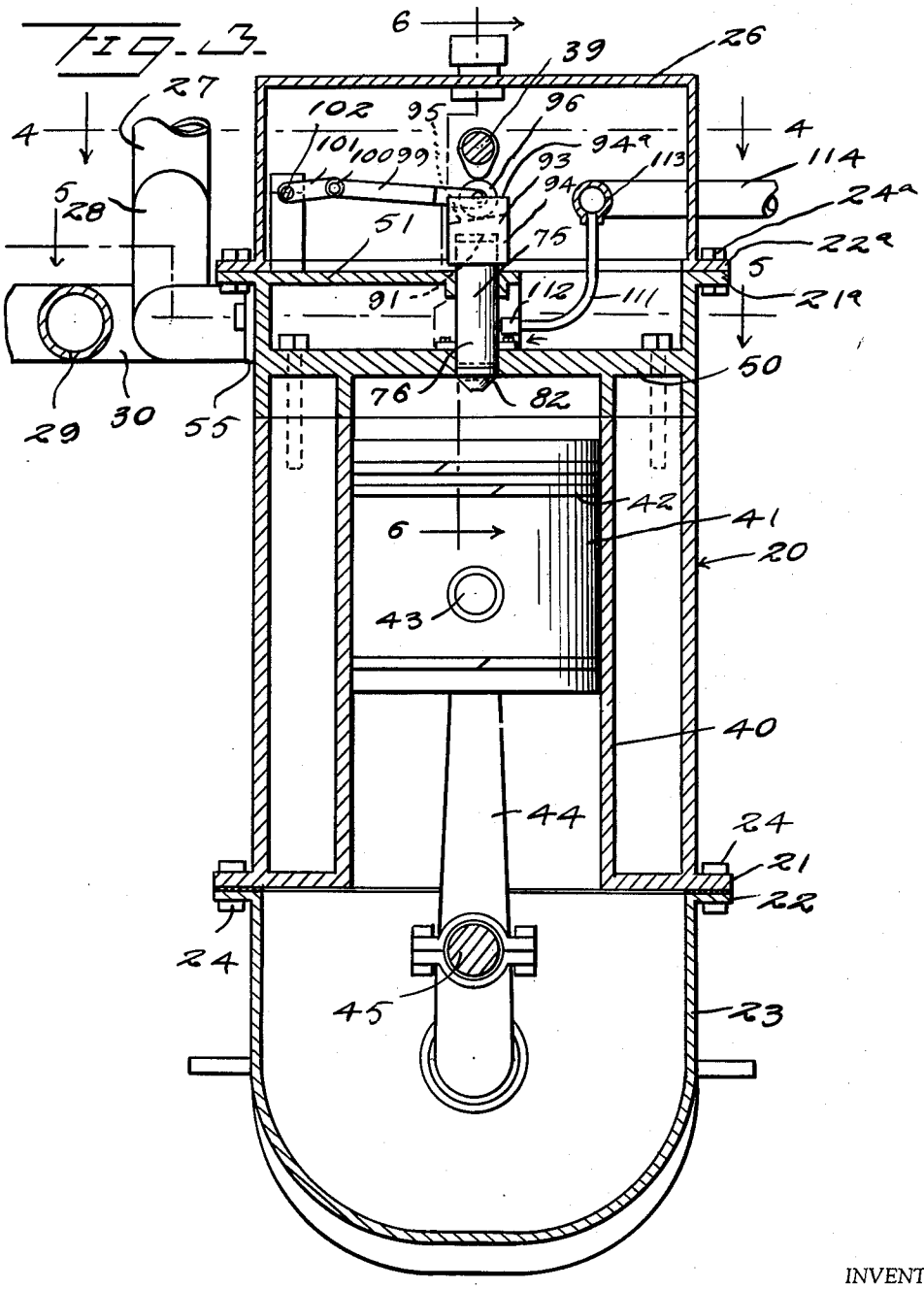
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FIG. 3.



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FUEL INJECTOR FOR INTERNAL-COMBUSTION ENGINES

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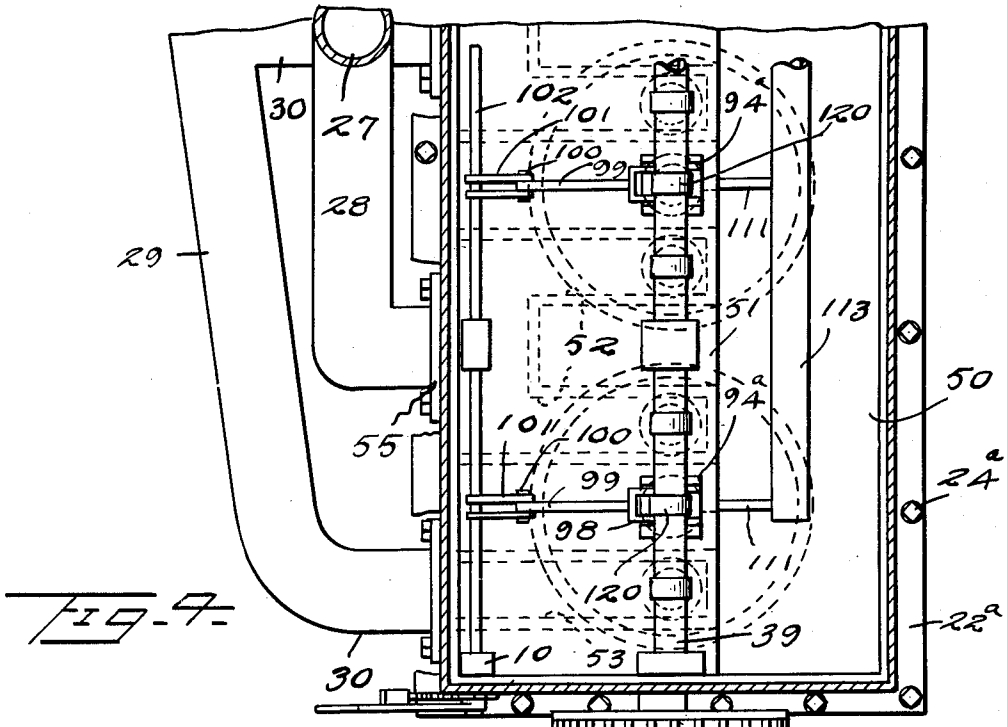


Fig. 4.

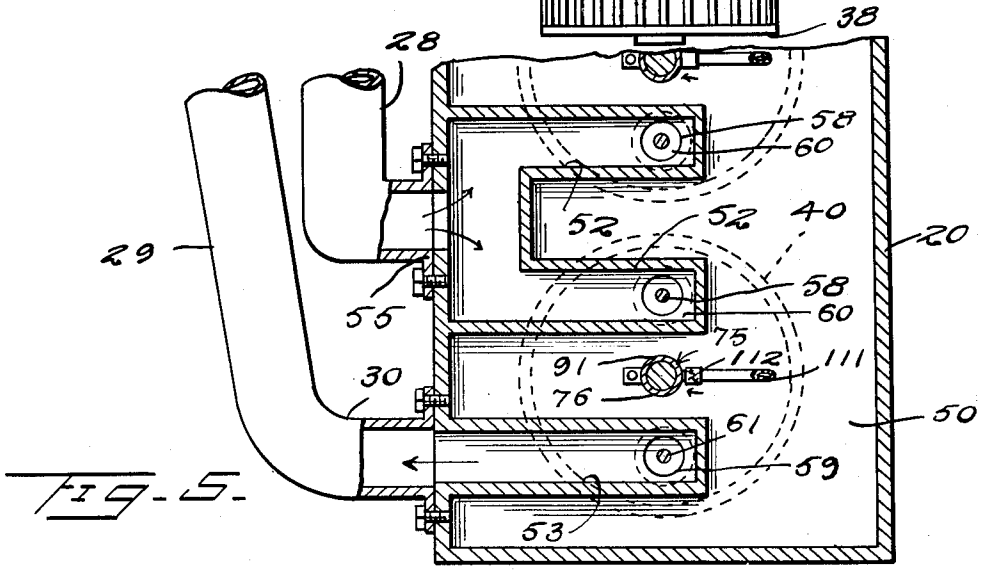


Fig. 5.

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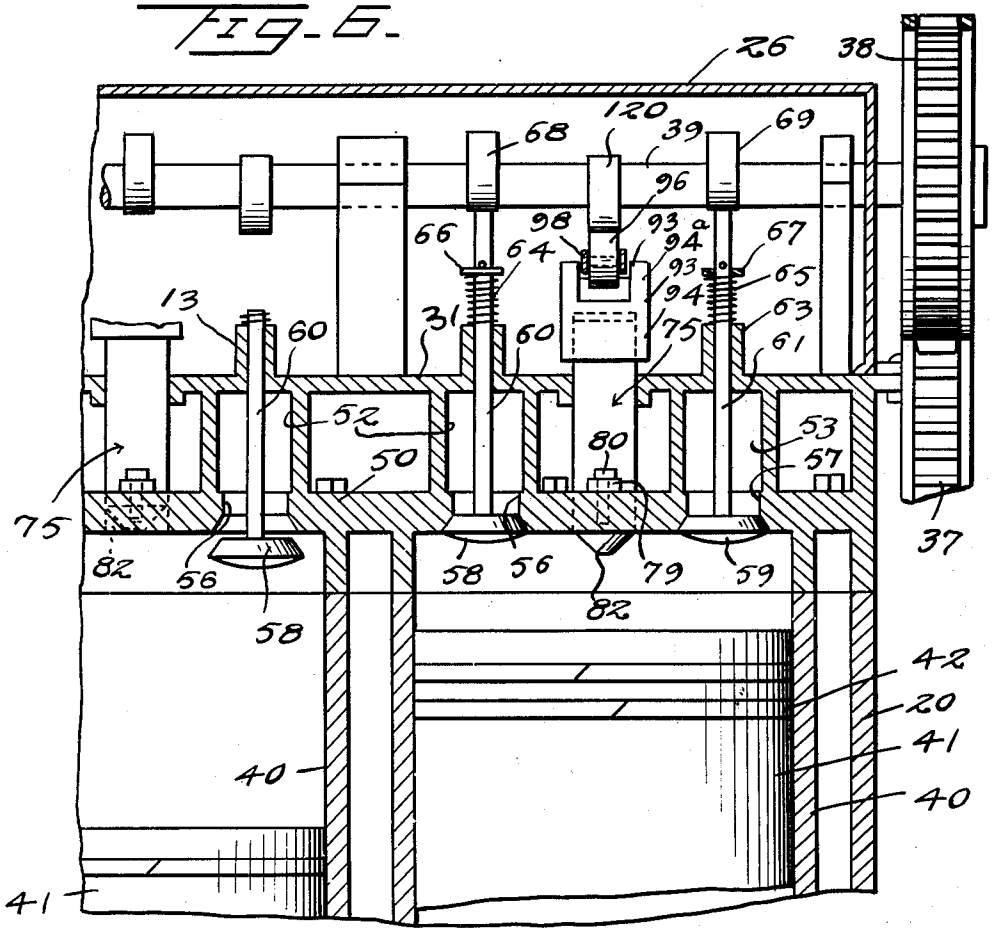
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FUEL INJECTOR FOR INTERNAL-COMBUSTION ENGINES

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Fig. 6.



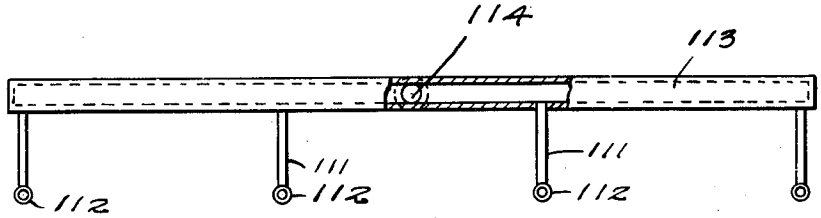


Fig. 10.

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FUEL INJECTOR FOR INTERNAL-COMBUSTION ENGINES

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FIG. 7.

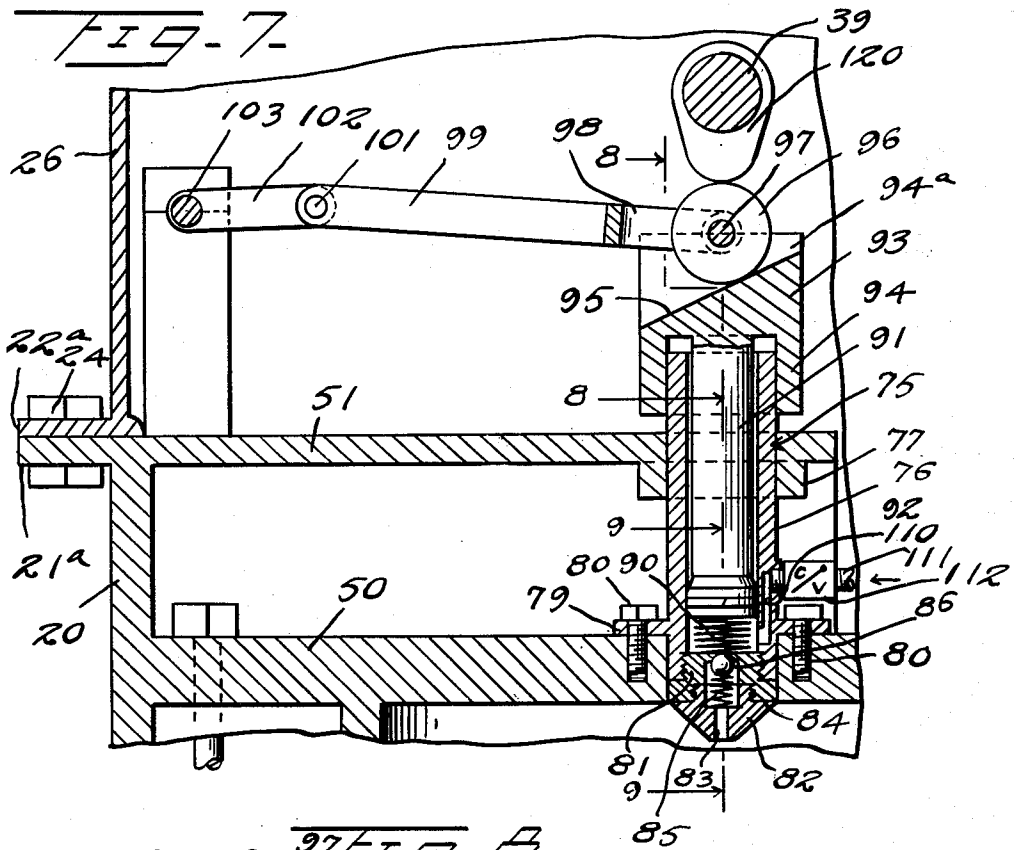
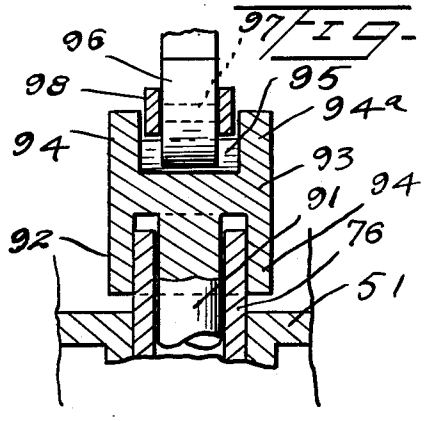


FIG. 8.



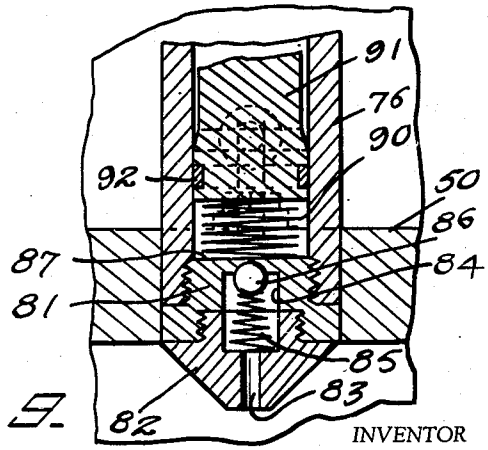


FIG. 9.

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Patented Apr. 20, 1954

2,676,061

UNITED STATES PATENT OFFICE

2,676,061

FUEL INJECTOR FOR INTERNAL-COMBUSTION ENGINES

Fred J. Arisman, Salem, Oreg.

Application April 24, 1951, Serial No. 222,556

1 Claim. (Cl. 299—107.2)

1

This invention relates to an internal combustion engine and has as its primary object the provision of such an engine which relies upon compression of a mixture of fuel and air, in the complete absence of any other ignition system for the operation of the individual cylinders of the engine.

A further object of the invention is the provision of such an engine provided with an improved injection system whereby extremely high pressures may be effected in the individual cylinders.

A still further object of the invention is the provision of an improved method for controlling the compression exerted by the injectors, and means therefor whereby the speed of the engine, and hence the vehicle or other device with which it is associated may be governed.

Still another object of the invention is the provision of a device of this character which is relatively simple and inexpensive to manufacture, which will be sturdy and durable in construction, which is reliable and efficient in operation, and which may be manufactured, assembled, and operated with a minimum fuel, and a consequent maximum of economy.

Still other objects reside in the combination of elements, arrangements of parts, and features of construction, all as will be more fully pointed out hereinafter and disclosed in the accompanying drawings wherein there is shown a preferred embodiment of this inventive concept.

In the drawings:

Figure 1 is a side elevational view of one form of engine embodying this invention.

Figure 2 is a fragmentary front elevational view of the construction shown in Figure 1, parts thereof being broken away and taken substantially along the section line 2—2 of Figure 1.

Figure 3 is an enlarged sectional view taken along the line 3—3 of Figure 1 as viewed in the direction indicated by the arrows.

Figure 4 is a sectional view taken substantially along the line 4—4 of Figure 3 as viewed in the direction indicated by the arrows.

Figure 5 is a sectional view taken substantially along the line 5—5 of Figure 3 as viewed in the direction indicated by the arrows.

Figure 6 is an enlarged sectional view taken substantially along the line 6—6 of Figure 3 as viewed in the direction indicated by the arrows.

Figure 7 is an enlarged fragmentary sectional view taken substantially along the line 7—7 of Figure 4 as viewed in the direction indicated by the arrows.

Figure 8 is a fragmentary sectional view taken

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substantially along the line 8—8 of Figure 7 as viewed in the direction indicated by the arrows.

Figure 9 is a sectional view taken substantially along the line 9—9 of Figure 7 as viewed in the direction indicated by the arrows, and

Figure 10 is a fragmentary elevational view partially broken away of a constructional detail comprising the fuel feed pipe of the instant invention.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings and particularly to Figures 1 and 2, there is generally indicated at 20 a conventional engine block provided with a lower flange 21 to which is secured an adjacent abutting flange 22 of a crankcase 23, the securing means taking the form of bolts 24.

Engine block 20 is also provided with a flange 21*a* to which is secured as by means of bolts 24*a* a correlated flange 22*a* integral with the head casing 26.

A main air intake pipe 27 provided with individual tubes 28 for the admission of air to the cylinders, in a manner to be described hereinafter is provided as is a main exhaust outlet 29 provided with individual branch tubes 30 (see Figures 3, 4, and 5).

Extending through the crank case 23 is a balanced crankshaft having a complete circular disc on each side of each connecting rod 35 to the forward extending end of which is secured a gear 36, which drives through a chain 37, a second gear 38 fixedly secured to a cam shaft 39 passed longitudinally through the head of the engine, in the manner and for a purpose to be more fully described hereinafter.

Referring now particularly to Figures 3 and 6, it will be seen that the interior of motor block is provided with a desired number of cylinders 40 within which are mounted pistons 41 of conventional design provided with the customary sealing rings 42 and pivotally secured as by pivots 43 to piston rods 44, the lower portions of which are secured in conventional manner to the eccentric portions 45 of the crankshaft 35.

Interiorly the engine block 20 is provided, as best shown in Figure 3, with a top sealing plate 50 for the cylinders and an upper plate 51 above the plate 50 which serves as a closure plate for air intake passages 52 and exhaust passages 53. It is to be pointed out that as best shown in Figure 5 each cylinder is provided with an intake and an outlet passage which in turn communicate with air inlets 26 and outlets 30, respectively,

through suitable ports in the side wall of engine block 20. The customary sealing gaskets may be provided for both inlet and exhaust passages. Each inlet and outlet is provided at its extremities with a port 56 and 57, respectively, which communicates with the interior of an adjacent cylinder on opposite sides thereof, and these ports are adapted to be closed by valves 58 and 59 setting in their respective apertures and opening downwardly, the valves being provided with stems 60 and 61, respectively, which extend upwardly through apertured bushings 62 and 63, respectively, in the tops of the ports. Springs 64 and 65 are engaged by suitable collars 66 and 67 secured to the stems normally biasing them upwardly to closed position.

Downward movement of the valve is effected by oppositely positioned cams 68 and 69, respectively, mounted on the cam shaft 39, and the cylinders are timed in a known manner to fire by means to be more fully described hereinafter in a selected predetermined order, and being admitted and exhausted from a selected cylinder in a desired sequence of operation in accordance with the position of cam shaft 35, which in turn is governed by the firing of the cylinders in a selected sequence of operation.

Each cylinder is provided at a point intermediate its exhaust and intake ports with a fuel injector assembly generally indicated at 75. The assembly as best disclosed in Figures 7, 8, and 9 is comprised of a sleeve 76 which extends through a bushing 77 carried by the underside of plate 51 and is provided with a flange 79 which is secured as by means of bolts to the top of closure plate 50. As best shown in Figures 7 and 8 the lower portion of the interior of the sleeve is threaded and provided interiorly with a closure valve nut 81, below which is threaded a plug 82 provided with a minute fuel passage aperture 83 and an interior recess 84.

Within recess 84 is positioned a compression spring 85 which serves to bias to closed position a ball check valve 86 which normally holds closed an aperture 87 in the top of valve nut 81, until such time as sufficient pressure is exerted on the other side thereof, in a manner to be more fully described to bias ball valve 86 to open position in a manner now to be described.

Seated on the top of valve nut 81 is a compression spring 90 which serves normally to bias upwardly a piston 91 provided with sealing rings 92, which extends upwardly the entire length of sleeve 76 and terminates in a cap 93 of cylindrical configuration provided with a sealing flange 94 which extends about the upper rim of sleeve 76. The upper portion of cap 93 is bifurcated to form a pair of ears 94a between which extends an inclined surface 95, adapted to be abutted by a movable roller 96, in the case of each injector mounted on an individual shaft 97. Each shaft 97 is mounted between the arms 98 of a bifurcated lever 99 which is pivotally connected as by means of a pivot 100 between a pair of arms 101 which arms are fixedly secured to a control rod 102, one end of which is journalled as at 103 (see Figure 4), and which is provided with any suitable control means not shown to permit rotation thereof.

It will thus be seen that rotation of control rod 103 will vary the position of rollers 96 relative to their associated inclined surfaces 95, for a purpose to be more fully described hereinafter.

Referring back to injector 75, it will be seen as best shown in Figure 7 that the wall of each sleeve 76 is provided with an aperture 110 which is in communication with a fuel feed pipe 111, a check valve 112 being provided in each case adjacent the sleeve wall on the exterior thereof. The fuel inlet for each cylinder communicates in turn with a fuel feed pipe 113 (see Figure 10) which is fed from a main fuel supply pipe 114.

The cam shaft 39 also carries adjacent each roller 96 an eccentric cam 120, the cam being adapted to engage in abutting relation with one surface of the roller 96, the other surface of which rides on the incline 95 of its associated cap 93, the arrangement being such that depression of piston 91 to a sufficient extent will close the port 110 cutting off the supply of fuel and causing fuel previously admitted to the chamber within sleeve 76 below the piston to be passed under pressure against the pressure of spring 85 on ball valve 86 through the aperture 83 into the cylinder. Conversely, as the piston is retracted the opening of the passage 110 is again opened to permit the admission of further fuel to be compressed on the next cycle of operation.

From the foregoing the operation of the device should now be readily understandable. The air is fed through inlet valve 58 to each cylinder in turn on the upstroke of the associated piston 41. Simultaneously as the compression of the air in the chamber near its maximum fuel is introduced into the space near the top of the piston 41 and the top of its associated cylinder, and upon the start of the retraction stroke of piston 91, compression within the cylinder 40 reaches its maximum causing an explosion of the volatilized fuel and air under high pressure. Such explosion will move the piston downwardly in a known manner to rotate crankshaft 35 which in turn will rotate cam shaft 39 to set up the next cylinder for sequential operation. Upon completion of the downstroke of the piston 41 the exhaust valve 59 will be open to prepare the cylinder for the next operation, the first portion of the upstroke of the piston serving to exhaust the waste gases from its associated cylinder. Obviously oxygen may be utilized in place of air if desired and in certain instances water injection in a known manner is contemplated.

Equally obviously the compression ignition of the instant invention may be applied to any engine of one or more cylinders. The means of controlling the speed of the engine should also be readily understandable. Obviously rotation of the shaft 103 will govern the relative position of its associated rolls 96 on their inclines 95. The farther up the inclines the rollers are located, the greater will be the effective area of cam 120, to occasion a greater progression of piston 91 within the sleeve 76 and, consequently, the forcing of a greater quantity of fuel into the cylinder through the aperture 83. Conversely, as the portion of the periphery of the roller is retracted the effective area through which cam 120 acts will be reduced, and the closer cap 93 will be permitted to come relative to the cam, thus correspondingly lessening the effective travel of piston 91 at the other end in reducing the quantity of fuel fed into the cylinder. Since the speed of the engine is directly governed by the quantity of fuel admitted thereto during any given time, it will be understood that there is thus provided effective means of speed control.

From the foregoing it will now be seen that there is herein provided an improved internal combustion engine which accomplishes all the objects of this invention and others including

many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept and as many modifications may be made in the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative, and not in a limiting sense.

What is claimed is:

A fuel injector comprising a tubular member, a jet nozzle in one end of said tubular member, a normally closed check valve in said nozzle, a fuel inlet pipe connected with said tubular member, a check valve in said fuel inlet pipe, a plunger slidable in said tubular member, a spring biasing said plunger outwardly of said tubular member, a cam shaft, means for rotating said shaft, a cam on said shaft, an end cap fixed to the opposite end of said plunger and slidably encompassing the outer end of said tubular member, said cap having an inclined channel in the outer end thereof, a regulating shaft laterally of said tubular member, a lever fixed on said regulating shaft, a link pivotally connected at one end with said lever and extending in the direction of said cap, and a roller rotatably carried by the opposite

end of said link interposed between said cam and said cap and engaging in said channel whereby rocking of said regulating shaft will move said roller lengthwise of said channel and thereby regulate the movement of said plunger by said cam.

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