Nov. 28, 1944. R. J. DEVORAK 2,363,576

FUEL CONTROL VALVE FOR DIESEL ENGINES

Filed Sept. 25, 1943 4 Sheets-Sheet 1

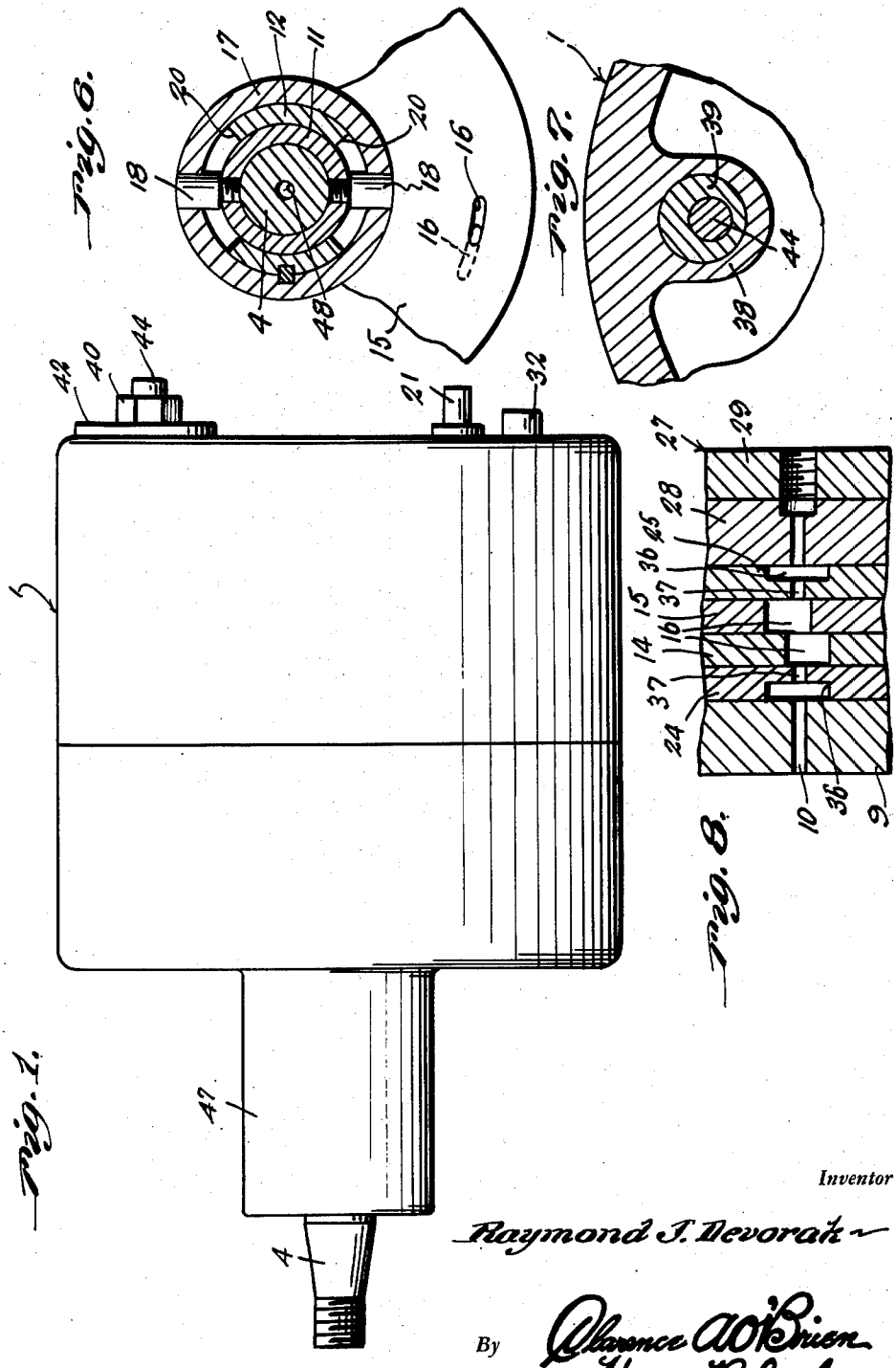

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Fig. 3.

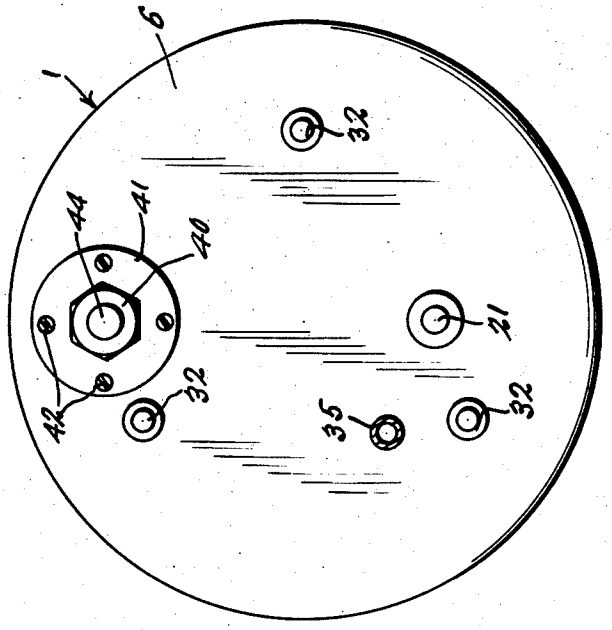


Fig. 10.

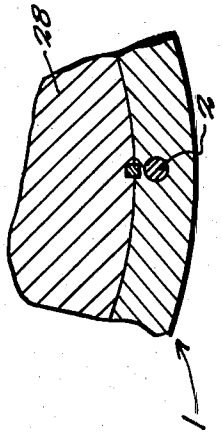


Fig. 2.

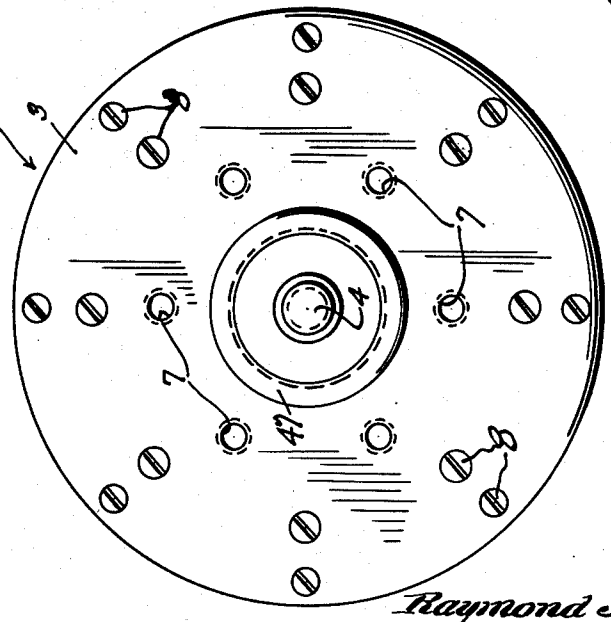
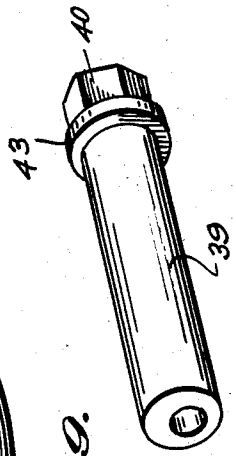


Fig. 9.



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FUEL CONTROL VALVE FOR DIESEL ENGINES

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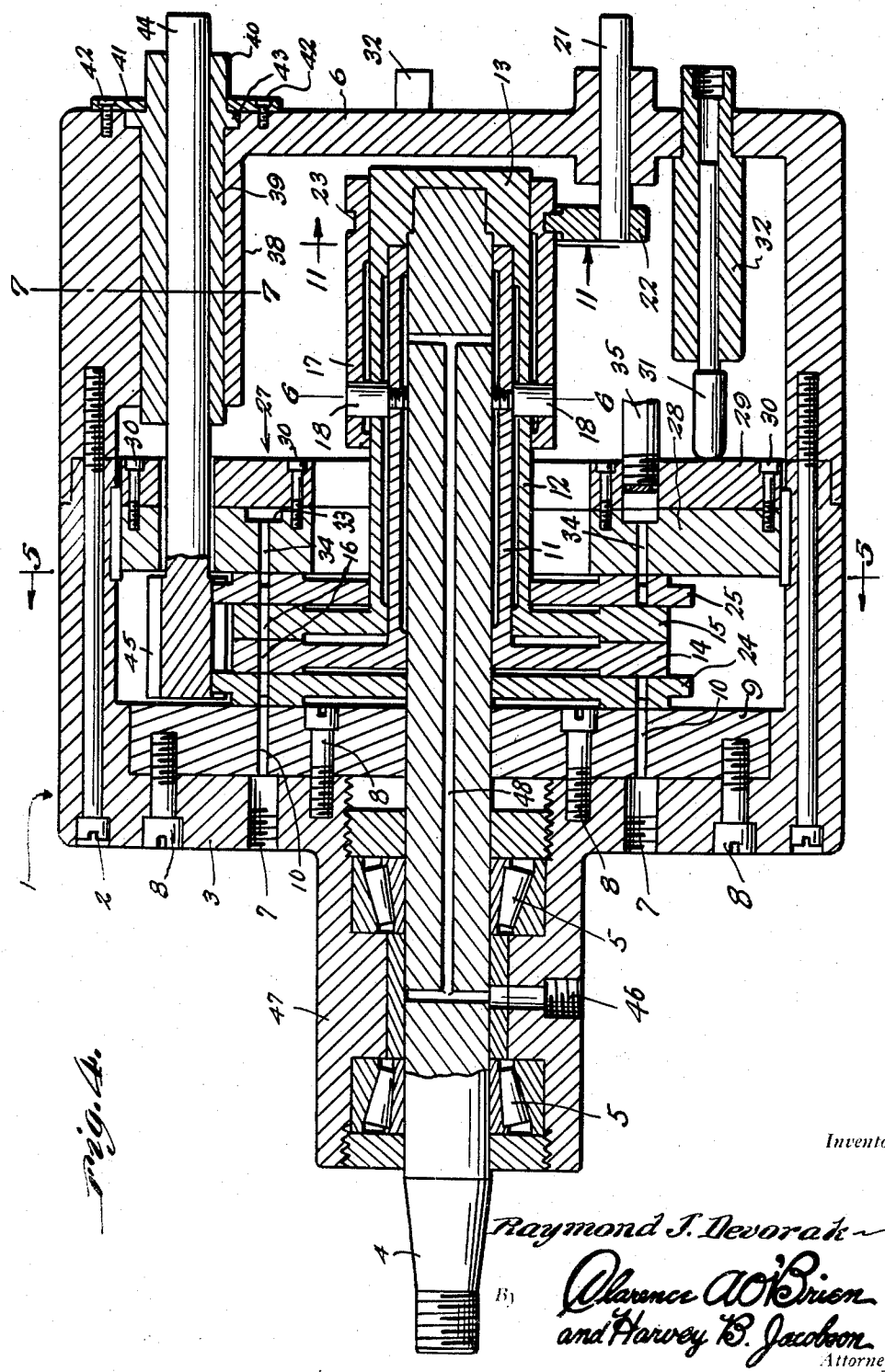

Fig. 4.

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FUEL CONTROL VALVE FOR DIESEL ENGINES

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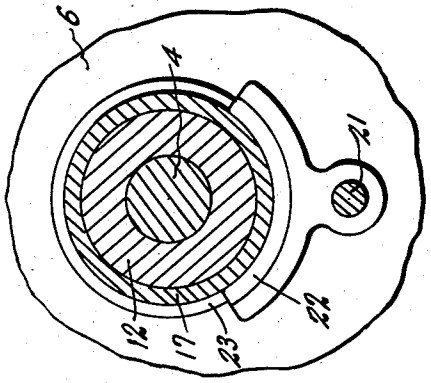

Fig. 11.

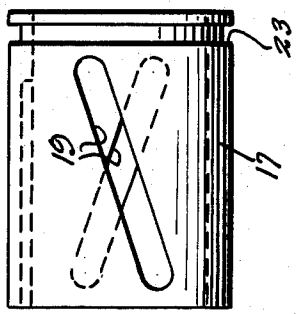

Fig. 12.

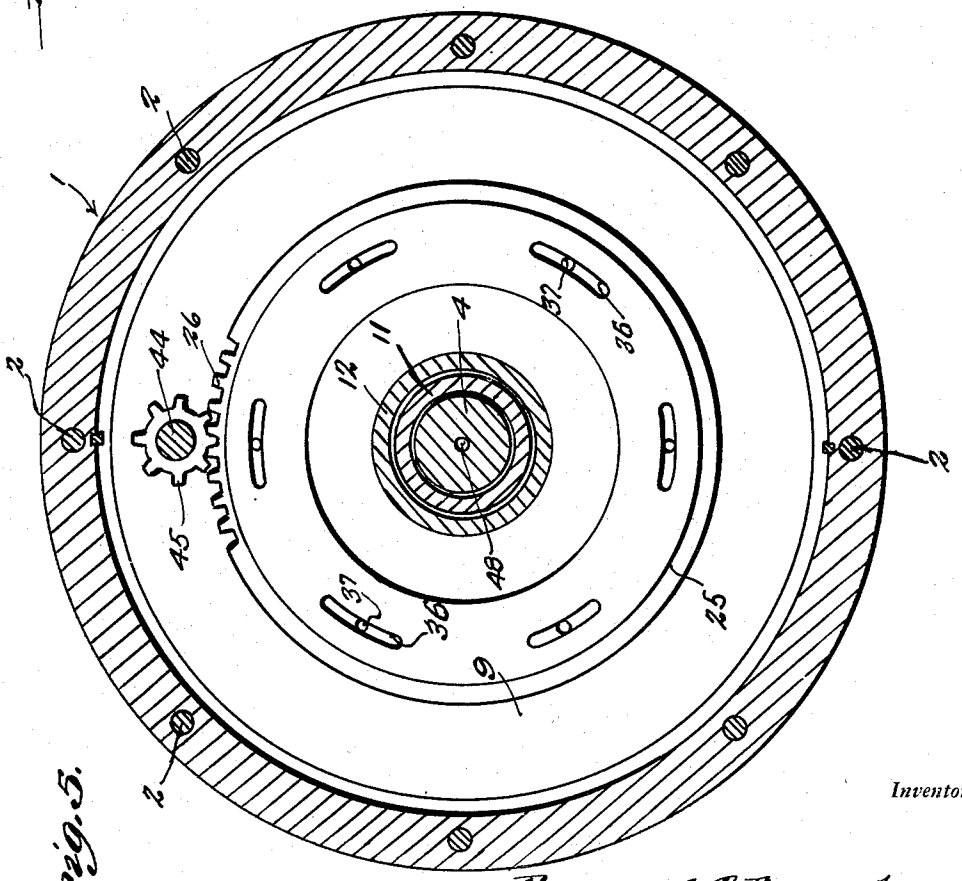

Fig. 5.

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FUEL CONTROL VALVE FOR DIESEL ENGINES

Raymond John Devorak, Minneapolis, Minn.

Application September 25, 1943, Serial No. 503,801

3 Claims. (Cl. 137—146)

The present invention relates to new and useful improvements in fuel control valves for Diesel engines, and has for one of its important objects to provide, in a manner as hereinafter set forth, a device of this character comprising a novel construction, combination and arrangement of disks, whereby the volume of fuel injected into each cylinder may be kept uniform and regulated as desired.

Another very important object of the invention is to provide a disk-type fuel control or measuring valve of the aforementioned character which may be automatically adjusted by the suction or vacuum in the intake manifold of the engine for advancing or retarding the fuel injections to meet various conditions as they develop.

Other objects of the invention are to provide a disk-type fuel measuring or control valve of the character described for Diesel engines, which valve will be comparatively simple in construction, strong, durable, highly efficient and reliable in operation, compact, and which may be manufactured at low cost.

All of the foregoing, and still further objects and advantages of the invention will become apparent from a study of the following specification, taken in connection with the accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views, and wherein:

Figure 1 is an elevational view of a valve constructed in accordance with the present invention.

Figure 2 is a view in front elevation of the device.

Figure 3 is a rear elevational view.

Figure 4 is a longitudinal sectional view through the valve.

Figure 5 is a cross-sectional view, taken substantially on the line 5—5 of Figure 4.

Figure 6 is a cross-sectional view, taken substantially on the line 6—6 of Figure 4.

Figure 7 is a fragmentary view in cross-section, taken substantially on the line 7—7 of Figure 4.

Figure 8 is a fragmentary view in section through the disk assembly.

Figure 9 is a detail view in perspective of the eccentric gear adjusting bushing.

Figure 10 is a fragmentary view in cross-section through a portion of the housing and the slidable follower.

Figure 11 is a cross-sectional view, taken substantially on the line 11—11 of Figure 4.

Figure 12 is a plan view of the measuring disk adjusting sleeve.

Referring now to the drawings in detail, it will be seen that the embodiment of the invention which has been illustrated comprises a cylindrical sectional housing of suitable dimensions which is designated generally by reference numeral 1. Bolts 2 detachably secure the sections of the housing 1 together. Extending longitudinally into the housing 1 through the forward end 3 thereof is a centrally located drive shaft 4. The drive shaft 4 is journaled in adjustable roller bearings 5 which are provided therefor on the front 3 of the housing 1. The drive shaft, it will be observed, terminates at a point adjacent the back or rear end 6 of the housing 1.

The front end 3 of the housing 1 has formed therein outlet openings 7 for receiving fuel lines to the injection nozzles in the cylinders of the engine. Bolts 8 in the front end 3 of the housing 1 rigidly secure a stationary disk or plate 9 in this end portion of said housing. Passages 10 in the plate 9 communicate with the outlets 7.

Inner and outer tubes 11 and 12, respectively, are mounted on the drive shaft 4 for rotation therewith in the housing 1. The outer tube 12 includes a closed rear end 13 which is fixed on the corresponding end portion of the shaft 4 for driving said tube from said shaft. Fuel distributing and measuring disks 14 and 15 are provided on the forward end portions of the tubes 11 and 12, respectively, said disks being in face abutting contact with each other. Each disk 14 and 15 has formed therein a circumferentially extending slot 16. The slots 16 communicate with each other.

A sleeve 17 is splined on the rear end portion of the outer tube 12. Pins 18 are mounted on the inner tube 11 and are engaged in cam slots 19 which are provided therefor in the sleeve 17. Openings 20 (see Fig. 6) in the outer tube 12 accommodate the pins 18. A throttle control rod 21 extends slidably through the back 6 of the housing 1 and is operatively connected to the sleeve 17 by a fork 22. A circumferential channel 23 in the rear end portion of the sleeve 17 accommodates the fork 22.

The drive shaft 4 rotates in an injection timing disk 24 which is slidable on said shaft between the disk 14 and the plate 9. The tube 12 has slidably mounted thereon and is rotatable in an injection timing disk 25 which is in contact with the disk 15. The disks 24 and 25, which are of greater diameter than the disks 14 and 15, are provided with peripheral gear teeth 26

(see Fig. 5), the purpose of which will be presently set forth.

A follower 27 is splined for longitudinal sliding movement in the housing 1 and abuts the disk 25. In the embodiment shown, the follower 27 comprises front and back plates 28 and 29, respectively, which are secured together by bolts 30. Fluid actuated plungers 31 in the rear end portion of the housing 1 are engaged with the follower 27 for urging said follower and the disk assembly forwardly in the housing against the stationary plate 9. The plungers 31 are operable in cylinders 32 which are to be connected to the fuel inlet line (not shown), thus utilizing the motor fuel as the actuating means for said follower. The face of the plate 28 of the follower 27 which abuts the plate 29 has formed therein an annular channel 33. Fuel passages 34 in the plate 28, which communicate with the channel 33, are aligned with the passages 10 in the stationary plate 9. A fuel inlet line 35, from the usual source of fuel under pressure, communicates with channel 33 and is connected to and suitably permits movement of the follower 27. For instance, the line 35 may include slidably telescoped sections, the movable section being connected to follower 27 to permit movement of the latter.

The injection timing disks 24 and 25 have formed in the faces thereof which are adjacent the members 9 and 28 circumferential grooves 36 which are in constant communication with the passages 10 and 34. These disks 24 and 25 are further provided, at intermediate points in the grooves 36, with ports 37 with which the slots 16 are brought into communication as the disks 14 and 15 rotate.

Mounted for rotary adjustment in a bearing 38 which is provided therefor in the rear portion of the housing 1 is an eccentric bushing 39. The bushing 39 includes a projecting rear end portion 40 which facilitates adjusting said bushing. A ring 41 is secured by bolts 42 on the rear end of the housing 1 and encircles the adjacent portion of the bushing 39, said ring being engaged with a flange 43 on the bushing for securing same in adjusted position.

A shaft 44 is journaled in the bushing 39 and the follower 27, said follower being slidable on said shaft. A gear 45 on the forward end of the shaft 44 is engaged with the teeth 26 on the disks 24 and 25 for rotatably adjusting said disks in unison relative to the disks 14 and 15 for timing the fuel injections. The shaft 44 may be connected in any suitable manner to the intake manifold of the engine for actuation by the suction or vacuum therein for automatically adjusting the disks 24 and 25. Also, the shaft 44 may be manually actuated, if desired.

It is thought that the operation of the device will be readily apparent from a consideration of the foregoing. Briefly, fuel enters the channel 33 from the line 35 and flows to the lines connected to the outlets 7 as the slots 16 in the rotating disks 14 and 15 move successively into communication with the ports 37 in the disks 24 and 25. As hereinbefore indicated, the shaft 4 drives the disks 14 and 15. Operation of the sleeve 17 longitudinally on the outer tube 12 with which said sleeve rotates rotatably adjusts the disk 14 relative to the disk 15 through the pins 18 for moving the slots 16 toward or away from registry with each other, thus varying the capacity of said slots for controlling the volume of fuel flowing therethrough. Rotation of the disks 24 and 25 by the gear 45 advances or retards the ports 37 for controlling the timing of the fuel injections. By rotating the eccentric bushing 39, the gear 45 may be adjusted relative to the disks 24 and 25 to compensate for wear. An oil pressure line is to be connected at 46 to the housing 47 of the bearings 5 for communication with ducts 48 in the drive shaft 4 for lubricating the moving parts.

It is believed that the many advantages of a valve constructed in accordance with the present invention will be readily understood, and although a preferred embodiment of the device is as illustrated and described, it is to be understood that changes in the details of construction and in the combination and arrangement of parts may be resorted to which will fall within the scope of the invention as claimed.

What is claimed is:

1. A valve of the character described comprising a housing, a shaft rotatable in said housing, means to continuously rotate said shaft a follower slidable in the housing, a fuel line connected to the follower, said follower having passages therein communicating with the line, the housing having outlets therein aligned with the passages, disks mounted on the shaft for rotary adjustment relative to the latter, further rotary disks mounted on and rotatable with the shaft and operable between the first-named disks, means for actuating said follower to compact said disks, said first-named disks having ports therein communicating respectively with the passages and the outlets, the rotary disks having circumferential slots therein communicating with each other and communicating successively with the ports, means for rotatively adjusting the rotary disks relative to each other, and means for rotatably adjusting the first-named disks relative to the rotary disks and to restrain them from rotation with the shaft.

2. A valve of the character described comprising a housing, a shaft rotatable in said housing, means to continuously rotate said shaft a follower slidable in the housing, a fuel line connected to the follower, said follower having passages therein communicating with the line, the housing having outlets therein aligned with the passages, disks mounted on the shaft for rotary adjustment relative to the latter, further rotary disks mounted on and rotatable with the shaft and operable between the first-named disks, means for actuating said follower to compact said disks, said first-named disks having ports therein communicating respectively with the passages and the outlets, the rotary disks having circumferential slots therein communicating with each other and communicating successively with the ports, means for rotatably adjusting the rotary disks relative to each other, and means for rotatably adjusting the first-named disks relative to the rotary disks and to restrain them from rotation with the shaft, the first-named means comprising inner and outer tubes on the rotating disks encircling the shaft, the outer tube being fixed to said shaft for actuation thereby, said outer tube having openings therein, a sleeve splined on the outer tube and having cam slots therein, and pins on the inner tube operable in the openings and engaged in the slots for rotating said inner tube upon sliding movement of the sleeve.

3. A valve of the character described comprising a housing, a shaft rotatable in said housing, means to continuously rotate said shaft a fol-

lower slidable in the housing, a fuel line connected to the follower, said follower having passages therein communicating with the line, the housing having outlets therein aligned with the passages, disks mounted on the shaft for rotary adjustment relative to the latter, further rotary disks mounted on and rotatable with the shaft and operable between the first-named disks, means for actuating said follower to compact said disks, said first-named disks having ports therein communicating respectively with the passages and the outlets, the rotary disks having circumferential slots therein communicating with each other and communicating successively with the ports, means for rotatably adjusting the rotary disks relative to each other, and means for rotatably adjusting the first-named disks relative to the rotary disks and to restrain them from rotation with the shaft, the last-named means including an eccentric bushing mounted for rotary adjustment in the housing, a shaft rotatably mounted in said bushing, gear teeth on the peripheries of the stationary disks, and a gear on the second-named shaft engaged with said teeth.

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