

March 5, 1940.

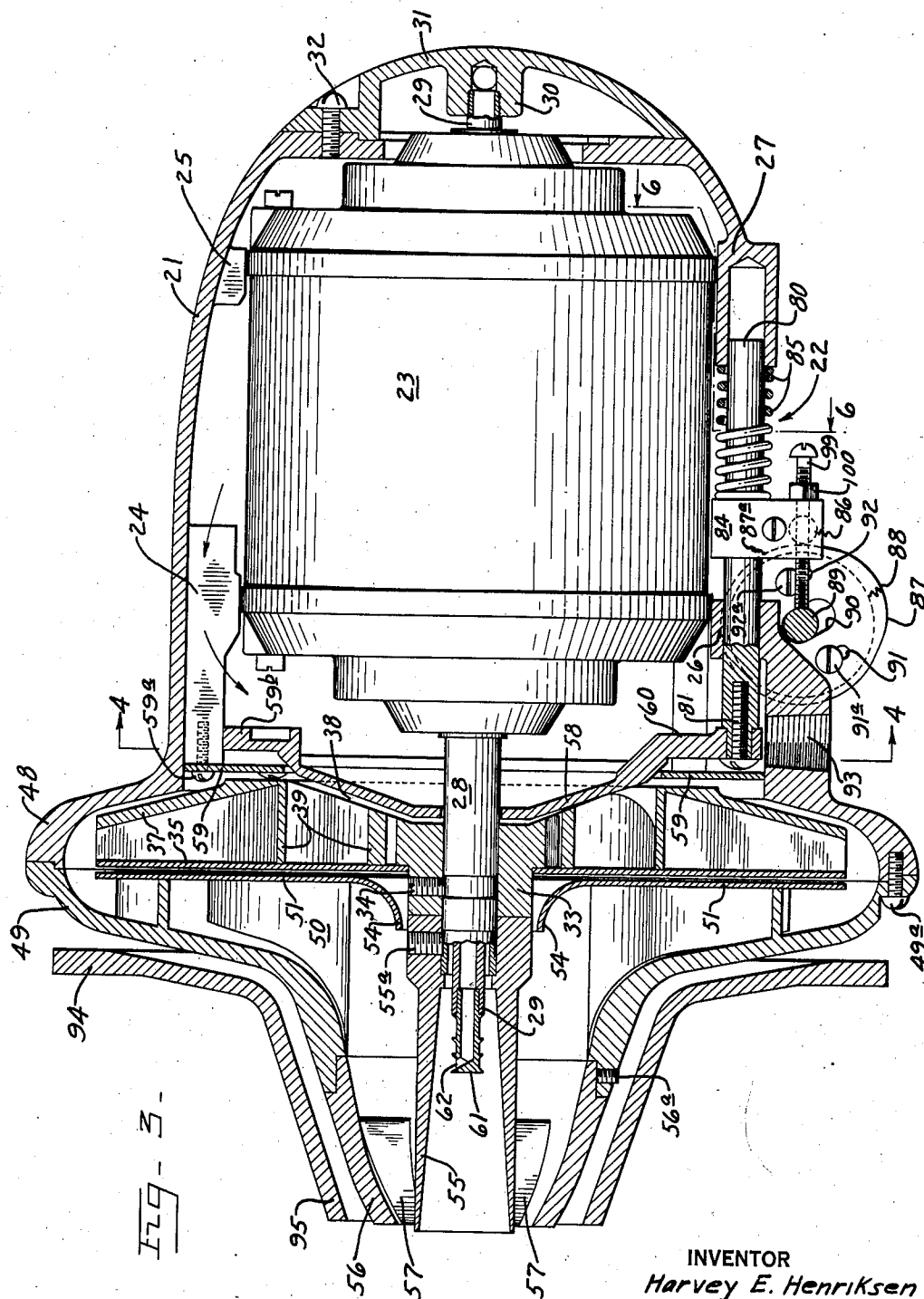
H. E. HENRIKSEN

2,192,346

BURNER CONTROL MECHANISM

Original Filed Dec. 13, 1937

3 Sheets-Sheet 2



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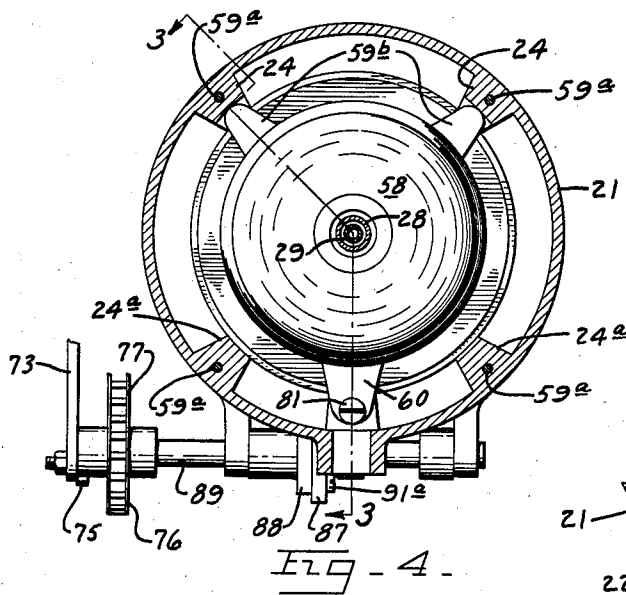
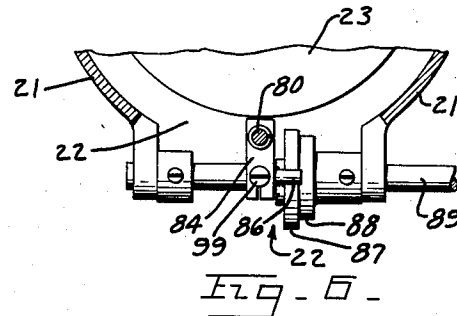
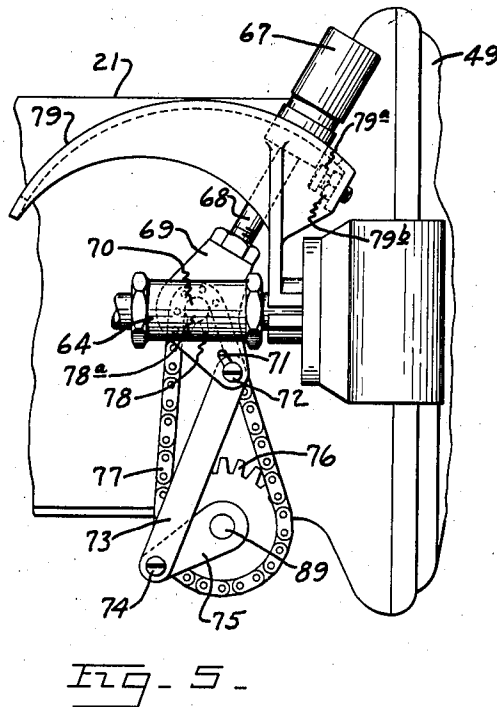
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UNITED STATES PATENT OFFICE

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BURNER CONTROL MECHANISM

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Original application December 13, 1937, Serial
No. 179,502. Divided and this application
September 3, 1938, Serial No. 228,411

9 Claims. (Cl. 158—1)

This invention relates to oil burners of the type in which oil in finely divided or atomized form is fed mixed with air, to the locus of combustion and more particularly to the control of the supply of fuel and air. My burner is preferably of the horizontal type, the oil being spun off of or out of a rotating cup mounted in the burner casing. A fan is usually in the burner casing for directing a blast of air into an annular space formed between the cup and a nozzle surrounding it, this blast of air aiding in the subdivision of the oil spun off by the cup and serving as the primary supply of air for combustion. An additional or secondary supply of air for combustion may flow through an annular space between the nozzle and a burner hinge plate which, as is the custom, may be attached to the furnace wall.

In oil burners of this type, proper co-ordination of the flow of air and the flow of fuel oil is a factor that is important. The amount of air required in actual practice is not actually, regardless of theory, proportional to the amount of oil being burned, and the changes in the rate of air flow as the rate of oil flow is changed have been made more or less empirically in actual practice, by guess of the operator.

Objects of my invention are to increase generally the burner efficiency; to simplify the control of air and of oil; to provide a simple, easily operable means for simultaneously controlling both the supply of oil and the supply of air; to provide an air-feed control dependent on the oil-feed control and which automatically varies the ratio of air to oil in the particular manner found best in actual practice; to provide an air-feed control of the nature referred to wherein the feed of air will not fall below a predetermined minimum even though but little oil be fed; to provide an air-feed control of the nature referred to wherein the feed of air will be constant when the feed of oil is lowered to and below a predetermined value; and other objects of the invention will become apparent on reading the specification of this application which is a division of my copending application, Serial No. 179,502, filed December 13, 1937.

Generally stated, my invention comprises providing a means operable by an adjusting lever or other simple control for changing the rate of feed of the fuel oil and simultaneously the rate of feed of the primary supply of air. The optimum rate of feed of such air is predetermined for each rate of feed of such oil, and there is a means to co-ordinate the rate of air flow to whatever rate

of fuel oil flow is chosen while the burner is in operation, so that the proper co-ordinated flow occurs in any position of the lever or other simple control means.

I have illustrated the preferred embodiment of my invention on the accompanying drawings which form a part of this specification and on which:

Fig. 1 is a plan view of my burner;

Fig. 2 is a rear elevation thereof;

Fig. 3 is a cross-section taken on the line 3—3 of Fig. 4 looking in the direction of the arrows, with parts in elevation;

Fig. 4 is a cross-section on the line 4—4 of Fig. 3, looking in the direction of the arrows;

Fig. 5 is side elevation from the right of Fig. 2, showing the control handle and appurtenant parts;

Fig. 6 is a cross-section on the line 6—6 of Fig. 3, but on a reduced scale.

The various views of the drawings illustrate the correct contour and proportions of the various parts and their relationship with respect to each other, as actually employed on my burner.

The greater part of my device is enclosed within a casing 21 which has an opening 22, preferably at the bottom thereof. An electric motor 23 is supported within the casing by contact with lugs 24, 25, 26, and 27. The motor shaft 28 is hollow, and within it is a stationary pipe 29 screwed into a hollow lug 30 on a casing cap 31 which is suitably fastened to the casing 21 by screws 32. A fan, which may be of any suitable character but which is preferably of the type disclosed in my parent copending application, Serial No. 179,502, is provided with a hub 33 attached to the hollow motor shaft 28 by means of one or more screws 34 passing through the fan hub and bearing against the shaft. The fan comprises a plate 35 attached to an impeller plate 37 having a central opening 38 and impeller vanes or blades 39 extending from the center thereof to the periphery. Air enters the fan from the right, as seen on Fig. 3, through the central opening 38 of the annular plate 37; and the impeller blades are so shaped adjacent said opening as to provide an inwardly dished or concave air inlet.

Casing 21 is flared outwardly as at 48 to confine and direct the air thrown outwardly by the fan; and this air is picked up and brought in toward the axis of the device to be discharged forwardly over the end of the oil feed which will be hereinafter described. For the purpose of so directing and discharging the air thrown outwardly by the fan, I provide a member 49 forming an

extension of the casing and attached to the casing part 48 by screws 49a, and which is provided with stationary vanes 50 which gather up the air flowing against them and deflect it centrally inwardly. A plate 51 is attached to vanes 50, and is provided with a central forward extension 54 which directs the air flowing between the stationary vanes 50 forwardly about the oil discharge cup 55 through which the oil is discharged to the left as seen on Fig. 3. A nozzle member 56 is attached to the casing plate 49, as by screws 56a, to receive the forwarded air, and interiorly thereof are deflecting vanes 57 shaped and arranged to give the air a rotative movement counter to that of the oil.

Oil flows through the stationary pipe 29 and through the conventional nozzle 61 at the end thereof. This nozzle may be of any suitable construction and preferably has an opening 62 at the upper side thereof to discharge the oil in a stream against the interior of the rotating oil discharge cup 55 which is mounted on and attached to the motor shaft, as by screws 55a. Due to its speed of rotation and its conical interior tapering outwardly toward the discharge end, the oil discharge cup spins the oil out from the end thereof imparting a rotative movement to the oil as it is spun out. The air discharged past the end of the oil discharge 55 rotates in a direction counter to that of the oil for the purpose of providing finer comminution and a better fuel mixture.

A hollow fitting 63 is connected to the supply of oil which is under at least sufficient pressure to make it flow to the burner at the maximum desired rate. From the fitting 63 the oil flows through a valve 64 which may be of any suitable conventional construction, and then through the pipe 66 into the hollow lug 30 from whence it flows through pipe 29 and out through the nozzle 61.

Such oil valve is opened and closed by an actuating stem rotatable through a range of over one hundred and eighty degrees (180°) between the wide open and shut positions. The actuating stem of the valve which controls the feed of oil to the burner is, in turn, controlled by an actuating or control lever which preferably is designed to swing through an angle of about ninety degrees (90°) for convenience of operation, but which is so connected with the valve through a step-up drive connection that such a ninety degree (90°) movement causes rotation of the actuating stem of the valve throughout its range of movement. This permits of a relatively short stroke of the lever adjusted by the operator to set the valve anywhere between the range of wide open to closed, and makes the control of the device more convenient and the device itself more compact. As an exemplification of this feature I provide an operating handle 67 at the end of a rod 68 which is secured into one arm 69 of a bell crank lever freely pivoted for rotatable movement at 70, the other arm of which has a slot 71 to accommodate the pin 72. This pin is at the end of link 73 pivotally connected at 74 to the crank 75 attached to the sprocket 76. A sprocket chain 77 extends about this sprocket and about a smaller sprocket 78 fixed on the valve control stem 78a, the rotative movement of which opens or shuts the oil valve.

The operating handle 67 rides over parallel guides 79 between which the rod 68 extends, and either one or both of these may be marked to indicate the comparative amount of oil being fed

when the operating handle is in any particular position. The guides are connected to each other at both ends to limit the movement of the handle 67. The limit of movement may be pre-adjusted, for example by means of an adjustable screw 79a threaded into the connection between the guides 79 at an end thereof, and a lock nut 79b to hold it fast in adjusted position. The end of the movement of the handle 67 may thus be adjusted. The mechanical movement so far described has the function of making the member which opens and closes the oil valve rotate through a greater angle than the movement of the operating handle.

I provide a connection between the operating handle 67 and a reciprocative air valve shutter plate 58 which controls the flow of air to the fan to that required for any particular quantity of oil fed to the burner. This plate 58 is mounted directly at the fan intake for sliding movement toward and away from a baffle plate or valve seat 59 located closely adjacent to the fan intake between the fan and the motor. This baffle plate is fastened by means such as screws 59a to the lugs 24, and additional lugs 24a may be provided for a similar purpose. The valve plate 58 is dish-shaped complementary to the fan intake and together with the baffle plate or seat 59 directs all air into the fan intake, to thereby provide a substantially uniform cone-like flow of air converging into the fan inlet well within the fan. Thus, atmospheric air can enter the burner through the wide opening 22 to a position closely adjacent the inlet to the fan and be consequently admitted into the fan under substantially atmospheric conditions.

The plate 58 has projecting lugs 59b and 60, the lugs 59b sliding along depressed portions of the lugs 24 to guide the plate in straight axial movement. The plate is attached to a rod 80 by means of a screw 81 passing through the lug 60. This rod is capable of longitudinal sliding movement in apertures through the lugs 26 and 27. An ear or lug 84 is fastened to the rod in adjustable position thereon and is forced to the left as seen on Fig. 3 by means of a compression spring 85. A pin 86 projects from the lug 84 and rides against a cam 87 attached to a cam-carrying plate 88 mounted on the shaft 89 upon which the sprocket 76 is mounted, so that this plate 88 will rotate with this sprocket. Cam 87 has a slot 90 passing through the center thereof so that the shaft 89 may pass therethrough, and is also provided with two additional slots 91 and 92 for permitting screws 91a and 92a to pass therethrough to enter threaded openings in the cam-carrying plate 88. The three slots permit of radial and circumferential adjustment of the cam with respect to the cam-carrying plate and the pin 86.

Such cam 87 is so shaped and so positioned that upon movement of the control lever 67 to vary the oil feed, the air shutter plate 58 will be moved differentially with respect to the oil feed control valve to thereby insure the proper air-oil ratios for varying fire conditions. In this connection, it is apparent that the contour of the cam may be predetermined to suit any burner operating conditions. Upon movement of lever 67 to supply more oil, the cam will be rotated so that it will push the pin 86 and thereby effect movement of rod 80; the spring 85 always maintaining the pin 86 in contact with the cam, so that when handle 67 is moved to close the oil valve, the shutter

58 will also be moved toward minimum air feed position.

The degree of firing may be controlled merely by movement of the operating handle 67 which as is now apparent controls the rate of flow of oil to the burner and adjusts the rate of feed of air for the maximum efficiency of the burner at the particular rate of feed of the oil. The cam has a dwell portion 87a in which rotation of the cam does not change the position of the pin 86 nor of the valve plate 58, because at the lower firing ranges when the burner is operating at substantially or close to minimum capacity it is best to be able to vary the flow of oil without changing the rate of flow of air.

A set screw 99 fitting in a threaded perforation in the lug 84 may be fixed in adjusted relation to the said lug by a lock nut 100. The end of this screw abuts against the shaft 89 and thereby holds the lug 84 at not less than predetermined distance to the right and so prevents the feed of air being less than a predetermined minimum. This permits of varying the minimum amount of primary air that may be fed to the fan, independently of the cam, and insures that when the burner is shut off and then subsequently started, there will always be a supply of air immediately available.

I usually attach my burner to a hinge plate 94 which is attached to the furnace wall, and which is shaped to form the outer nozzle 95 between which and the nozzle 56 is an annular path through which the secondary air supply of combustion may flow by natural draft. The burner is attached to the hinge plate by means of the hinge 101 so that it can be swung away from the opening or maintained in operative position by the usual latch 97 maintained in position by the spring 98. In case it is desired to mount the burner on a pedestal, a screw threaded opening 93 is provided to receive the pedestal, such opening being plugged when the burner is mounted on the hinge plate.

From the preceding, it is seen that my burner may thus be controlled very simply, easily, quickly and effectively by a simple movement of a single control lever. In addition to this the burner operates very efficiently at all settings of the control lever because the supply of air is the optimum for that rate of flow of liquid fuel to which the burner may be adjusted by moving the operating handle 67. This result is primarily due to the provision of cam 87, the contour of which may be so designed as to insure that for all firing conditions, as determined by the quantity of fuel oil admitted to the burner, the proper amount of primary air to obtain maximum efficiency, may be supplied through the burner. In this connection, it is important to note that previous arrangements which permit change in the air feed directly proportional to changes in oil feed, are not conducive of best efficiency because for substantially minimum firing conditions, it is undesirable to change the primary air feed for slight increases in the amount of fuel oil supplied to the burner; while for higher firing conditions, I have found it desirable to increase the primary air feed less than the fuel feed. Furthermore, the contour of the cam may be so shaped as to permit proper air-fuel ratios at all firing conditions. By virtue of the adjustability of the cam such ratios may be changed, to insure proper firing conditions under various environ-

ments in which the burner may be installed for operation.

Various details have been referred to for the purpose of describing but not limiting the invention and which may be varied without departing from the spirit thereof.

I claim:

1. A burner comprising a valve member for controlling the feed of fuel, a valve member for controlling the feed of air, a movably mounted cam of predetermined contour, spring-pressed mechanism connected to said air-feed valve member and having means in free riding engagement with said cam, a control member free of direct connection with either of said valve members, and means including a sprocket and chain drive connected to said control member to operate both said fuel-feed valve member and said cam.

2. A burner comprising a valve member for controlling the feed of fuel, a valve member for controlling the feed of air, a cam of predetermined contour mounted for rotation about an axis, an axially movable rod connected to said air-feed valve member, resilient means for urging said rod in a direction to close said air-feed valve member, a pin connected to said rod and urged into free riding engagement with said cam by said resilient means, a control member free of direct connection with either of said valve members, and means connected to said control member to operate both said fuel-feed valve member and said cam.

3. In a burner having a valve member for controlling the feed of fuel and a valve member for controlling the feed of air; control mechanism therefor comprising a cam of predetermined contour mounted for rotation about an axis, an axially movable rod for connection with said air-feed valve member to move the same, resilient means for urging said rod in a direction adapted to close said air-feed valve member, a pin connected to said rod and urged into engagement with said cam by said resilient means, interconnected wheels one of which is connected to rotate said cam and another of which is for connection with said fuel-feed valve member to operate the same, and a control member connected to one of said wheels.

4. In a burner having a valve member for controlling the feed of fuel and a valve member for controlling the feed of air; a control member; and mechanism for operating simultaneously said valve members upon operation of said control member comprising interconnected wheels one of which is for connection with said fuel-feed valve member and another of which is for connection with said air-feed valve member, a pivotally mounted bell crank having one arm connected to said control member, and a linkage connection between another arm of said bell crank and one of said wheels.

5. In a burner having a valve for controlling the mount of fuel and a valve for controlling the amount of air; control mechanism therefor comprising a cam of predetermined contour, an axially movable rod for connectoin with said air valve to move the same, a rotatable member for connection with said fuel valve, resilient means for urging said rod in a direction adapted to move said air valve toward closed position, means carried by said rod and urged into engagement with said cam by said resilient means, an adjustable stop element to limit the movement of said rod to enable said air valve always to re-

main open at least an adjusted amount, peripherally interconnected wheels of different sizes, means connecting the larger wheel to said cam, means connecting the smaller wheel to said rotatable member for said fuel valve, and a single control member connected to one of said wheels.

6. In a burner having a valve for controlling the amount of fuel and a valve for controlling the amount of air; control mechanism therefor comprising a cam shaft, a cam of predetermined contour mounted on said cam shaft, an axially movable rod for connection with said air valve to move the same, a rotatable member for connection with said fuel valve, resilient means for urging said rod in a direction adapted to move said air valve toward closed position, a pin carried by said rod and urged into engagement with said cam by said resilient means, an abutment, an adjustable element also carried by said rod and urged by said resilient means toward said abutment to enable said air valve always to remain open at least a predetermined amount, peripherally interconnected wheels of different sizes, the larger wheel being mounted on said cam shaft, means connecting the smaller wheel to said rotatable member for said fuel valve, and a single control member connected to one of said wheels.

7. Control mechanism for a burner air valve and a burner fuel valve comprising a rotatable shaft for connection with said fuel valve, an axially reciprocable rod for connection with said air valve, a cam rotatable about an axis extending crosswise with respect to said rod, means carried by said rod to engage said cam, a wheel, means connecting said wheel to said cam for rotation about the same axis as said cam, a second wheel connected to said rotatable shaft, means interconnecting said wheels, a movable control lever, and means connecting said lever to one of said wheels to turn the same upon movement of said lever and transmit a drive to the other of said wheels through said interconnecting means.

8. Control mechanism for a burner air valve

and a burner fuel valve comprising a rotatable shaft for connection with said fuel valve, an axially reciprocable rod for connection with said air valve and extending crosswise with respect to said rotatable shaft, resilient means for urging said rod axially in one direction, a rotatable cam shaft extending crosswise with respect to said rod and substantially parallel to said rotatable shaft, a cam carried by said cam shaft, means carried by said rod and urged into free riding engagement with said cam by said resilient means, a sprocket wheel carried by said cam shaft, a second sprocket wheel carried by said rotatable shaft, a pivoted control lever, means connected to said control lever for turning said cam shaft wheel upon movement of said control lever, and a chain connecting said wheels to transmit a drive to said second wheel upon turning of said cam shaft wheel.

9. Control mechanism for a burner air valve and a burner fuel valve comprising a rotatable shaft for connection with said fuel valve, an axially reciprocable rod for connection with said air valve and extending crosswise with respect to said rotatable shaft, resilient means for urging said rod axially in one direction, a rotatable cam shaft extending crosswise with respect to said rod and substantially parallel to said rotatable shaft, a cam carried by said cam shaft, means carried by said rod and urged into free riding engagement with said cam by said resilient means, a sprocket wheel carried by said cam shaft, a second sprocket wheel carried by said rotatable shaft, a pivoted control lever, means connected to said control lever for turning said cam shaft wheel upon movement of said control lever, and a chain connecting said wheels to transmit a drive to said second wheel upon turning of said cam shaft wheel, the cam shaft wheel being of greater diameter than said second wheel to enable a relatively short range of movement of said control lever to impart a greater range of movement to said rotatable shaft for said fuel valve.

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