March 25, 1952 C. E. BODEY 2,590,674

VALVE

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Fig. 1.

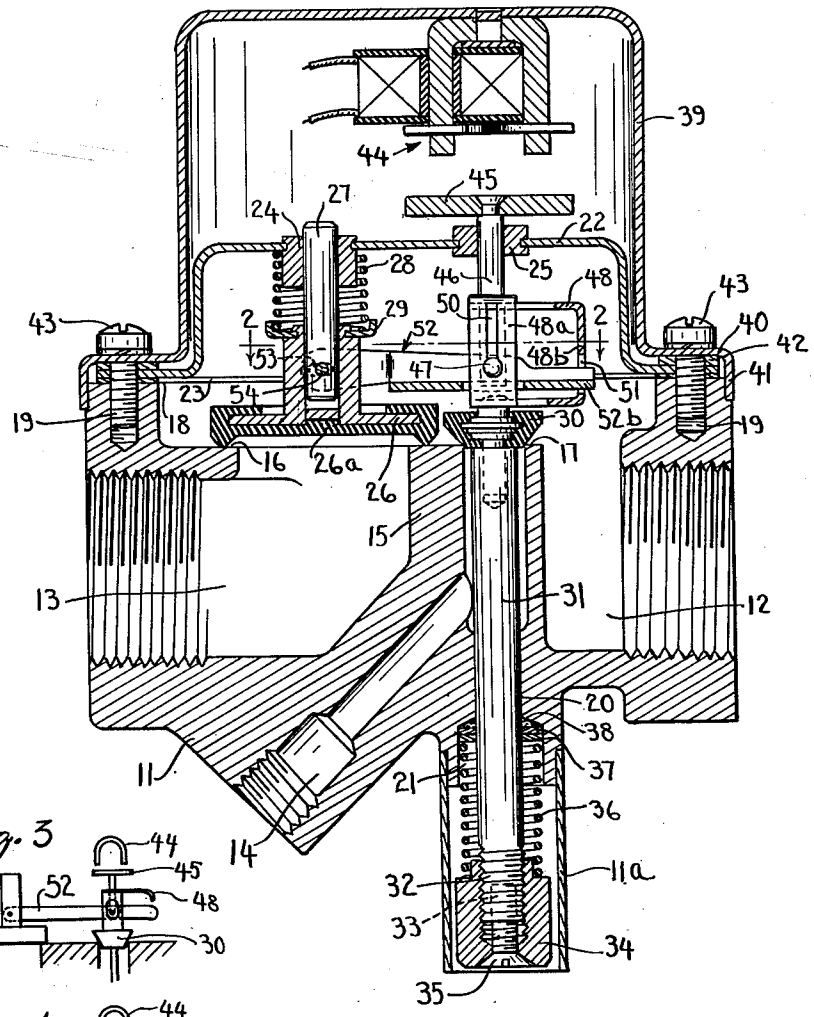


Fig. 3

Fig. 4

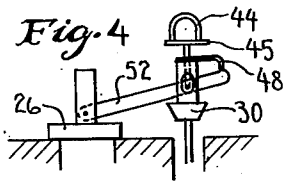


Fig. 5

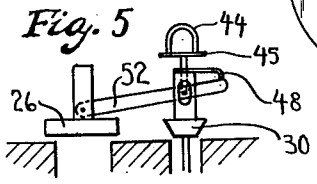
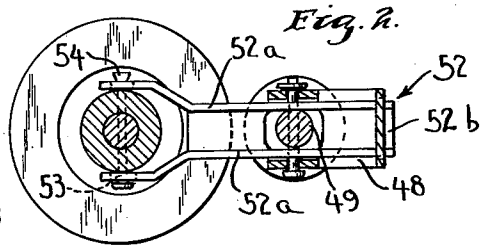


Fig. 2.



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UNITED STATES PATENT OFFICE

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VALVE

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13 Claims. (Cl. 137—139)

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This invention relates to fluid flow control devices generally and, more particularly, to a gas valve which is adapted to control the flow of fuel gas to a main burner and to a pilot burner for the main burner. While it will become apparent, upon reading the following description, that the invention could advantageously be used in fluid flow systems wherein fluid is to be supplied from a single source to two or more devices, the invention will be described as being applied to a fuel burning system.

In supplying fuel gas to a furnace, wherein there is usually a main burner and a pilot burner for igniting the main burner, it is customary to provide a safety valve which will shut off the flow of gas to the main and pilot burners whenever the flame at the pilot burner becomes extinguished. This is to prevent the escape of unburned gas into the surrounding atmosphere and to prevent an explosion due to the ignition of this unburned gas. Also, in order to put the burner back in operation, it is customary to provide in the valve controlling the flow of gas to the furnace a manual preset mechanism which when operated, first permits the flow of gas to the pilot burner and then, after the pilot has been burning a few seconds, permits the flow of gas to the main burner. This is usually accomplished by having a thermopile positioned in the pilot burner so as to energize an electromagnet when the pilot is burning and having the electromagnet so related with the reset mechanism as to permit the return movement of the manual control to open said main valve. Such a valve is shown in a Joesting Patent 2,118,886, dated May 31, 1938, and numerous other patents well known in the fuel burning art.

An object of this invention is to provide a compact and an inexpensive but reliable valve for accomplishing a safety reset of the fuel delivery means of a gas burning furnace.

Another object of the invention is to provide a safety reset valve which has an adjustable means for varying the "drop-out" point of the electromagnet, that is, the degree of energization of the electromagnet which permits the armature holding the valve in its open position to leave the electromagnet and thus close the valve.

A further object of the invention is to provide a pilot outlet tapping in the valve body which is readily connectable to most any gas furnace installation.

A still further object of the invention is to provide a fluid flow control valve that is readily disassembled and reassembled and wherein the elements of the valve are simple, sturdy and of durable construction.

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Additional objects of the invention will become apparent upon reading the following detailed description of the invention in conjunction with the accompanying drawing wherein:

Figure 1 is a cross-sectional view of the fluid control device;

Figure 2 is a cross-sectional view of a portion of the fluid flow control device taken along line 2—2 of Figure 1; and

Figures 3, 4 and 5 are schematic illustrations of the relative positions assumed by the elements of the control device during the actuation of the device from its closed position to its operative position.

The invention comprises a valve body 11 having a threaded inlet 12, a threaded outlet 13 for discharging a large amount of fluid, as to a main burner of a furnace, and a threaded outlet 14 for discharging a smaller amount of fluid, as to a pilot burner. A partition 15 has a valve seat 16 at the upstream end of the outlet 13 and a valve seat 17 at the upstream end of the outlet 14. The body is open at its top, as shown at 18, while the wall surrounding the open top has annularly spaced screw threaded bores 19 for a purpose to be described below. A bore 20 extends through the bottom wall of the body from a vertical portion of the outlet 14 to a recess 21 in the outer surface of said bottom.

An inverted cup-shaped partition 22 has an outwardly flanged portion which rests on the top wall of the valve body with a gasket 23 therebetween. This partition has bearing members 24 and 25 staked in openings therein in axial alignment with the valve seats 16 and 17, respectively.

A main valve 26, having a covering of rubber or other relatively soft material 26a, rests on the valve seat 16. The valve has a stem 27 which extends through the bearing member 24 to provide guided axial movement of the valve away from and toward the valve seat. A spring 28 surrounds the lower portion of the bearing member 24 and bears against the under side of the partition 22 at one end thereof and against an upwardly cupped shoulder member 29 staked to the valve 26. This spring normally holds the valve 26 against the valve seat 16.

A valve 30, also made of relatively soft material and which normally engages the valve seat 17, is secured to a valve stem 31. The stem extends through the inner portion of the outlet passage 14, through the bore 20 and through the recess 21 to a point beyond the bottom sur-

face of the body. The outer end of the stem 31 is screwthreaded at 32 and has a screwthreaded bore 33 extending inwardly from the outer end. A sleeve-like knob 34 is internally threaded and mounted for axial adjustment on the threaded portion 32 of the stem 31. A lock screw 35 has a head portion, which bears against the lower end of the knob 34, and a body portion, which extends upwardly inside of said knob and into screwthreaded engagement with the threaded bore 33 for locking the knob 34 in its adjusted position on the stem 31. A spring 36 bears against the upper end of the knob 34 and extends upwardly into recess 21 and into engagement with packing washers 37 to sealingly compress packing 38 against the body and against the stem 31, to prevent the escape of gas through the bore 20. It is thus seen that by loosening the lock screw 35 and by adjusting the knob 34, the pressure that the spring 36 exerts in a valve closing direction may be varied to satisfy any particular need. A removable sleeve 11*a* frictionally engages a portion of the body 11 to protect the stem 31 and knob 34 from damaging blows and accidental actuation thereof.

An inverted cup-shaped sealing housing 39 has an outwardly extending flange 40, extending parallel to the flange on the partition member 22, and a downwardly extending flange 41 which surrounds the upper marginal portion of the valve body. A gasket 42 is positioned between flange 40 and the flange on the partition member 22. The housing, the partition and the gaskets are all clamped to the top portion of the valve body by means of a plurality of screws 43 passing through aligned holes in said members and screwthreaded into the bores 19.

An electromagnet, generally designated by the reference numeral 44, the details of which form no portion of this invention, is suitably secured to the top portion of the housing 39 by means, not shown. The coil of this relay is adapted to be sufficiently energized to hold a cooperating valve-supporting armature by the current generated by a small thermopile not shown. The leads from the electromagnet's coil are adapted to be connected to the leads from the thermopile through a suitable terminal block (not shown) mounted on the housing 39.

The armature 45, which cooperates with the electromagnet 44, is loosely staked to the upper end of a stem 46 so as to assure complete contact of the upper surface of the armature against the poles on the electromagnet. Stem 46 extends downwardly through the bearing member 25 and carries a pivot pin 47 at its lower end.

Referring now to Figure 2, as well as Figure 1, mechanism whereby the armature 45 is moved into engagement with the electromagnet 44 and the main valve is caused to be opened will now be described. A yoke member 48 has an opening 49 in the upper surface thereof, through which the stem 46 is vertically slidable, and is riveted or otherwise secured to the upper side of the valve 30. The yoke has two vertical side walls 48*a* which are vertically slotted at 50 to slidably receive the ends of the pivot 47 extending outwardly from the stem 46. This slot therefore provides relative movement between the armature and the valve 30 for a purpose to be presently described. An end wall 48*b* of the yoke member has a vertical slot 51 to slidably receive a free end of a floating lever 52, now to be described.

The floating lever 52 comprises two laterally spaced arms 52*a* bridged by a horizontally extending portion 52*b*. The left hand ends of the arms 52*a* are outwardly bowed, so as to straddle the body portion of the valve 26, and are longitudinally slotted at 53 to slidably receive a pin 54 extending through the valve body and the stem 27. The slot is to provide slight transverse movement of the lever 52 with respect to the stem as the lever 52 is pivoted. The intermediate portion of the lever 52 extends between the side walls 48*a* of the yoke member with the outer free end of the lever extending through the slot 51 in the wall 48*b* of the yoke member. Lever 52 is pivoted on the armature stem 46 by the pivot 47. The coaction of the elements of a device, as well as their structural dimensions, will become clear upon reading how the valve operates, which will now be described.

Operation

With the valve of this invention installed in a gas heating system, such as a domestic heating system, with the inlet 12 connected to a source of gas supply, the outlet 13 connected to a main burner, the outlet 14 connected to a pilot burner, and the leads to the electromagnet 44 connected to a thermopile heated by said pilot burner, the heating system will be in its shutdown condition due to the fact that the pilot valve 30 and the main valve 26 are in their closed positions, as illustrated in Figures 1 and 3.

To place the heating system into operation, the knob 34 is shoved inwardly as far as it will go, that is, until the armature 45 engages the electromagnet 44, as illustrated in Figure 4. Gas will thus be permitted to flow from the inlet 12 past the valve 30 and out through the outlet 14 to the pilot burner, where the gas may be ignited manually or by a remote ignition means, not shown. It will be noted that when the armature has been moved to engagement with the electromagnet 44, yoke member 48 has been moved to its uppermost position and the floating lever 52 has been pivoted about pivot 54 to an angular relationship with respect to the stems 31, 46 and 27 with the upper surface of the free end close to or in engagement with the upper end of the slot 51. The spring 28 will hold the valve 26 against the valve seat 16 during this lifting movement of the valve 30 and armature 45. The knob 34 must be held in this uppermost position for a time sufficient to allow energization of the electromagnet by the thermopile. This time is usually of only a few minutes duration at the most. Upon the electromagnet becoming energized, releasing of the knob 34 will permit the spring 36 to move the valve 30 toward its seat 17 with the pivot 47 sliding in slot 50. Downward movement of the stem 31 will cause the yoke 48 at the upper end of slot 51 to bear down on the free end of the lever 52 and rock said lever about pivot 47 to raise the valve 26 against the bias of spring 28 as illustrated in Figure 5. The relative strengths of the springs 36 and 28 are such that spring 36 can overcome spring 28 an amount sufficient to move the valve 26 to its wide open position but not permit the valve 30 to move to its closed position. It will thus be seen that the pivot 47 will assume a position substantially midway the length of the slot 50. Due to the shorter distance between the pivot 47 and the slot 51 than between the pivot 47 and the pivot 54, yoke member 48 will return a smaller distance after the top of the slot 51 en-

gages the top of lever 52 than the main valve 26 will be raised. It is thus seen that by properly dimensioning the slot 51, the distance that the pilot valve 30 will return toward its seat 17 may be satisfactorily limited. Both the main valve 26 and the pilot valve 17 will remain in their open position so long as the electromagnet remains energized.

Should the pilot flame become extinguished during the operation of the furnace, the electromagnet will obviously become deenergized and permit the armature 45 to drop away from the electromagnet 44. This causes the closing of both valves 30 and 26 due to the bias of both spring 28 and spring 36. Also, should the pilot burner become clogged so as to give an inadequate flame for heating the thermopile up to its normal operating temperature, a dangerous condition would then exist due to the fact that the pilot flame would probably be unable to ignite the main burner. Therefore, it is desirable that the drop out value or degree of energization of the electromagnet be adjustable so as to assure proper dropping out of the armature and closing of the valves for any pilot burner installation. This adjustment is provided in the present invention by the adjustable knob 34 varying the compression of the spring 36. If it is desired that the armature drop out when the pilot flame drops only a small amount below its normal intensity, the knob 34 will be screwed inwardly on the stem 31 to increase the compression of the spring 36. If it is desired that the armature drop out only if the flame goes out or drops considerably below the normal flame intensity, the knob 34 will be adjusted outwardly on the stem 31.

Shutdown of the furnace may be accomplished by manually pulling the knob 34 outwardly so as to pull the armature 45 away from the electromagnet, or by extinguishing the pilot flame manually, or by disconnecting one of the leads from the thermopile to the terminal block on the valve.

Conclusion

From the above detailed description of the invention, it is apparent that this new valve provides safe starting of a furnace as well as ready installation in the furnace system and provides means for externally adjusting the valve so as to vary the dropout value of the safety control mechanism.

As various modifications may be made of the present invention by those skilled in the art, without departing from the spirit thereof, it is to be expressly understood that the scope of the invention is to be determined solely by the appended claims.

I claim as my invention:

1. A fluid flow control device comprising a body having an open top, an inlet in said body, a main outlet and a second outlet in said body, a cup-shaped partition spanning said open top and having spaced guide openings therein, a main valve having a stem extending through one of said openings, a spring between said valve and said partition normally biasing said valve into sealing relationship with said main outlet, a second valve having a stem extending through a portion of said second outlet and through the bottom of said body, a spring positioned between said body and an abutment on the outer end of said second valve stem and normally biasing said second valve into sealing engagement with the inner end of said second outlet, a housing superimposed around said partition and supporting an electromagnet generally above a second guide opening in said partition, an armature cooperable with said electromagnet and having a stem extending through said second guide opening, said electromagnet being strong enough when energized to hold but not attract said armature, a lever pivoted at one end to said main valve and connected intermediate its ends to the lower end of said armature stem by a pivot, and a yoke secured to said second valve, said yoke having an axially extending slot through which said pivot extends and a laterally spaced slot through which the other end of said lever extends, said slots being of such length and position as to enable said second valve stem and yoke to be manually moved to position said armature into engagement with said electromagnet and to rotate said lever about its pivotal connection with said main valve and, when released with said armature being held by said electromagnet, to enable said yoke to engage said other end of said lever and rotate said lever so as to move said main valve open while preventing the complete return of said second valve to its seating position.

2. A fluid control device as defined in claim 1 wherein the abutment on the outer end of said secondary valve stem is longitudinally adjustable on said stem.

3. A fluid flow control device comprising a body having an open side, an inlet in said body, a main outlet and a second outlet in said body, a partition spanning said open side and having spaced guide openings therein, a main valve having a stem extending through one of said openings, a spring between said valve and said partition normally biasing said valve into sealing relationship with said main outlet, a second valve having a stem extending through a portion of said second outlet and through the bottom of said body, a spring positioned between said body and an abutment on the outer end of said second valve stem and normally biasing said second valve into sealing engagement with said second outlet, a housing superimposed around said partition and supporting an electromagnet generally above a second guide opening in said partition, an armature cooperable with said electromagnet and having a stem extending through said second guide opening, said electromagnet being strong enough when energized to hold but not attract said armature, a lever pivoted at one end to said main valve and connected intermediate its ends to the lower end of said armature stem by a pivot, and a yoke secured to said second valve, said yoke having an axially extending slot through which said pivot extends and a laterally spaced slot through which the other end of said lever extends, said slots being of such length and position as to enable said second valve stem and yoke to be manually moved to position said armature into engagement with said electromagnet and to rotate said lever about its pivotal connection with said main valve and, when released with said armature being held by said electromagnet, to enable said yoke to engage said other end of said lever and rotate said lever so as to move said main valve open while preventing the complete return of said second valve to its seating position.

4. A fluid flow control device comprising a body having an open top, an inlet in said body, a main outlet and a second outlet in said body, a cup-shaped partition spanning said open top

and having spaced guide openings therein, a main valve having a stem extending through one of said openings, a spring between said valve and said partition normally biasing said valve into sealing relationship with said main outlet, a second valve having a stem extending through the bottom of said body, a spring positioned between said body and an abutment on the outer end of said second valve stem and normally biasing said second valve into sealing engagement with the inner end of said second outlet, a housing covering said partition and supporting an electromagnet generally above a second guide opening in said partition, an armature cooperable with said electromagnet and having a stem extending through said second guide opening, said electromagnet being strong enough when energized to hold but not attract said armature, a lever pivoted at one end to said main valve and connected intermediate its ends to the lower end of said armature stem by a pivot, and a yoke operably engaging said second valve and having an axially extending slot through which said pivot extends and a laterally spaced slot through which the other end of said lever extends, said slots being of such length and position as to enable said second valve stem and yoke to be manually moved to position said armature into engagement with said electromagnet and to rotate said lever about its pivotal connection with said main valve and, when released with said armature being held by said electromagnet, to enable said yoke to engage said other end of said lever and rotate said lever so as to move said main valve open while preventing the complete return of said second valve to its seating position.

5. A fluid flow control device comprising a body having an open side, an inlet in said body, a main outlet and a second outlet in said body, a partition spanning said open side and having spaced guide openings therein, a main valve having a stem extending through one of said openings, a spring between said valve and said partition normally biasing said valve into sealing relationship with said main outlet, a second valve having a stem extending through the bottom of said body, a spring positioned between said body and an abutment on the outer end of said second valve stem and normally biasing said second valve into sealing engagement with said second outlet, a housing covering said partition and supporting an electromagnet generally above a second guide opening in said partition, an armature cooperable with said electromagnet and having a stem extending through said second guide opening, said electromagnet being capable of holding but not attracting said armature, a lever pivoted at one end to said main valve and connected intermediate its ends to the lower end of said armature stem by a pivot, and a yoke secured to said second valve, said yoke having an axially extending slot through which said pivot extends and a laterally spaced slot through which the other end of said lever extends, one end of said axially extending slot being engageable with said pivot in said armature stem for lifting said armature into engagement with said electromagnet when said second valve is opened and one end of the laterally spaced slot being engageable with said other end of said lever only when said armature is being held by said electromagnet and said second valve stem is free to return toward its normal sealing position.

6. In a valve, the combination comprising a valve body having two valve seats, a first valve biased toward one of said seats, a second valve

biased toward said second seat, an armature, an electromagnet capable of holding but not attracting said armature, a lever pivoted to said first valve and to said armature cooperating therewith, a yoke member connected to said second valve and having a first lost motion connection with said armature and a second lost motion connection with said lever, and a manual actuator connected to said second valve, said first lost motion connection being operable to lift said armature into engagement with said electromagnet and said lever almost into engagement with said yoke at said second lost motion connection and said second lost motion connection being operable to pivot said lever about its pivotal connection with said armature to open said first valve and partially return said second valve toward its seat under the bias of said second valve when said armature is being held by said electromagnet.

7. In a valve, the combination comprising a valve body having two valve seats, a first valve biased toward one of said seats, a second valve biased toward said second seat, an armature, an electromagnet capable of holding but not attracting said armature, a lever pivoted to said first valve and to said armature, a yoke member connected to said second valve and having a first lost motion connection with said armature for lifting said armature and a second lost motion connection with said lever for lifting said first valve by rocking said lever about its pivotal connection with said armature when said armature is held by said electromagnet, and an actuator connected to said second valve and extending to the exterior of said valve body.

8. In a control device having a first and a second control member and a condition responsive unit capable of holding said control members in their operating position but incapable of moving them to said position, the improvement comprising a lever pivoted to said first control member and to a portion of said condition responsive unit, a yoke connected to said second control member, said yoke having a first lost motion connection with said portion of said condition responsive unit and a second lost motion connection with said lever, and means for moving said second control member to place said portion and said second control member in operative position, said means being operable through said lost motion connections to move said first control member to its operative position only if said condition responsive means is holding said portion thereof and said second control member in operative position.

9. In a control device having a first and a second control member, and a condition responsive unit capable of holding said control members in their operating position but incapable of moving said members to said position, the improvement comprising a lever pivoted to said first control member and to a movable portion of said condition responsive unit, a yoke connected to said second control member, said movable portion of said yoke having a pin and slot connection with said condition responsive unit for moving said second member and said portion to operating positions and a lost motion connection with said lever for rocking said lever and moving said first member to its operating position, and means for manually moving said second control member into operating position and for returning it to its inoperative position when released by said condition responsive unit.

10. A value comprising a valve body having two valve seats, a main valve biased toward one of said seats, a second valve having a stem extending through a wall of said body, an actuating member on the outer end of said stem for moving said second valve to an open position and having means for axial adjustment thereof on said stem, resilient means between said member and said body biasing said stem outwardly and said second valve towards its seat, means capable of holding said valves in their open position but incapable of moving said valves to said position, and lost motion connecting means between said main and second valve for actuating said main valve to its open position by return movement of said second valve part way toward its seating position when said holding means is in its valve holding condition.

11. A valve comprising a valve body having two valve seats, a main valve biased toward one of said seats, a second valve having a stem extending through a wall of said body, a manually operable member on the outer end of said stem having means for axial adjustment thereof on said stem, means between said member and said body biasing said stem outwardly and said second valve towards its seat, condition responsive means capable of releasably holding said valves in their open position but unable to move said valve to said position, and means between said main and second valve for actuating said main valve to its open position by movement of said second valve part way toward its seating position when said holding means is in its valve holding condition.

12. A control device comprising a first control member movable between operating and inoperating positions, means biasing said first control member to its inoperating position, a second control member manually movable between operating and inoperating positions, means biasing said second control member to its inoperating position, condition responsive means capable of holding but incapable of moving said valves into their operating positions, a lever pivoted at one of its ends to said first control member and intermediate its ends to a movable portion of said condition responsive means, means movable by said second control member for moving said portion into operating position and being separable therefrom, said last mentioned means having an abutment thereon normally spaced from the other end of said lever but engageable with said other end when said movable portion is held in operating position, said second mentioned biasing means being sufficiently strong that, when said second control means is free to move in response thereto and only when said movable portion is held in operating position, it is capable of engaging and rotating said lever about its intermediate pivot and move said first control member to its operating position against the action of its biasing means.

13. A control device as defined in claim 12 wherein said second control means is substantially in axial alignment with said movable portion of said condition responsive means.

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