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2,187,045

ELECTRICAL CONTROL FOR VALVES

Filed Dec. 10, 1937

2 Sheets-Sheet 1

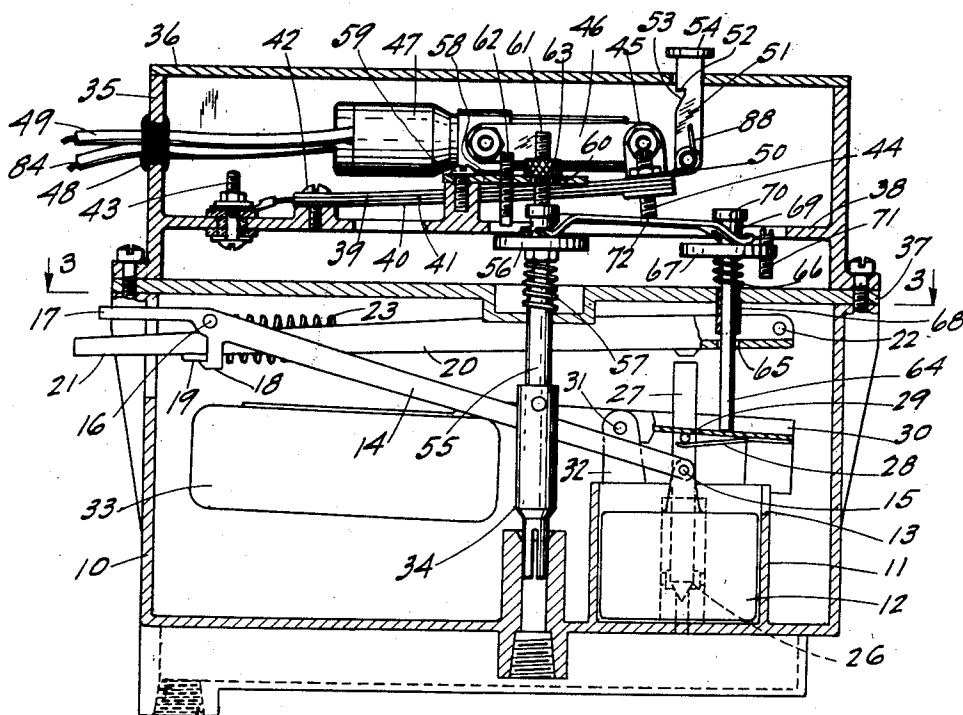


Fig. 1.

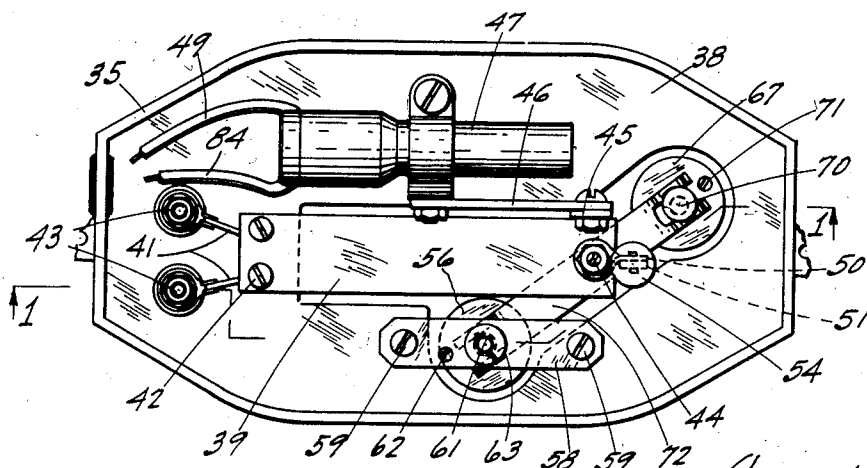


Fig. 2.

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2 Sheets-Sheet 2

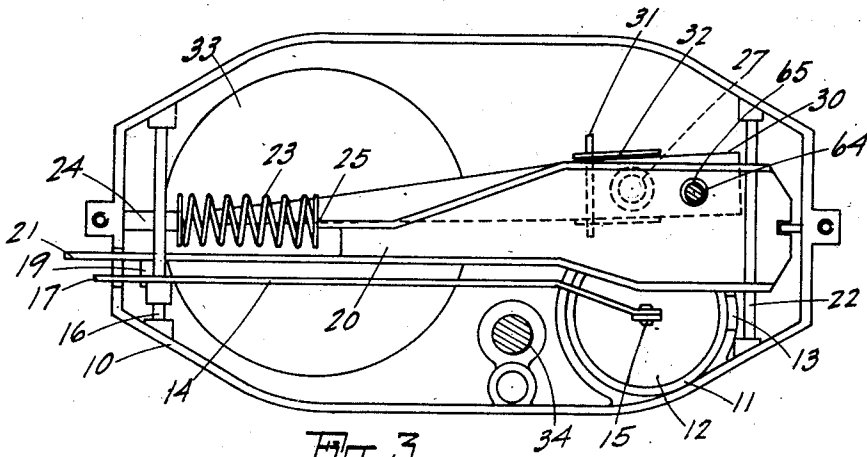


Fig. 3.

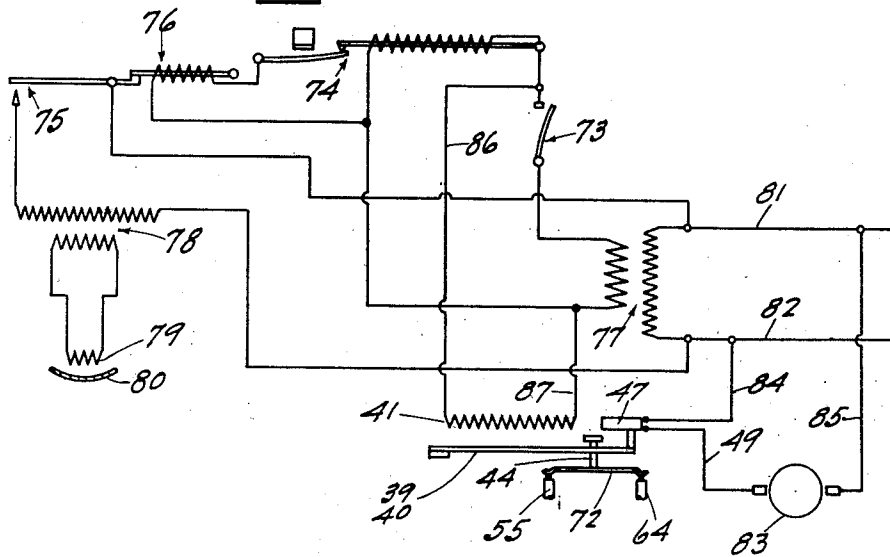


Fig. 4.

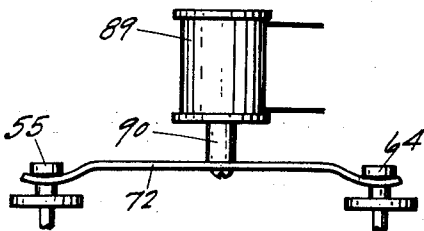


Fig. 5.

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2,187,045

ELECTRICAL CONTROL FOR VALVES

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tion of California

Application December 10, 1937, Serial No. 179,131

16 Claims. (Cl. 137—144)

This invention, an electrical control for fuel valves is mainly intended for use as an auxiliary device for attachment to standard types of fuel flow control valves and devices for fuel oil burning systems, and is intended to place the flow and feeding of fuel oil under direct control of a room thermostat. The application is not limited to the control of fuel, as it may readily be adapted for the control of valves for other fluids and purposes.

The objects and advantages of the invention are as follows;

First; to provide means through the medium of which a fuel valve for a furnace is directly under the control of a room thermostat.

Second; to provide a means of the type outlined which is attachable to standard types of valves.

Third; to provide a means as outlined which will control the metering and inlet valves of a fuel control valve in such manner that either valve may be caused to open before the other in any sequential time-delay relation, and in which the valves are very slowly opened so as to admit fuel to the burner of the furnace at gradually increasing volume as the burner becomes heated, and in which the sequence of closing of the valves can be governed at will.

Fourth; to provide a control as outlined with a single electrically-actuated element for controlling both valves.

Fifth; to provide the single electrically-actuated element in the form of a resistance heated bi-metallic warp element.

Sixth; to provide the control with high-low metering means which is adjustable at will, and independently adjustable for high and low fire operation.

Seventh; to provide a control as outlined which will not interfere with the normal functioning of the valves for closing, but which will positively close the valves in the event of current failure or breaking of the circuit by the room thermostat.

Eighth; to provide means for releasing the valves to open at will in the event of current failure, and to provide latching means therefor, which latching means is automatically releasable when the electric circuit has been re-established.

Other objects and advantages of the invention will become apparent as the following description is read on the drawings forming a part of this specification, and in which similar reference characters are used to designate similar parts throughout the several views, of which;

Fig. 1 is a side sectional elevation through the invention, shown attached to a float valve control of standard construction, and is taken on a line 1—1 of Fig. 2.

Fig. 2 is a top plan view of Fig. 1, with the cover removed.

Fig. 3 is a section taken on line 3—3 of Fig. 1, and shows the interior construction of one type of float valve to which the invention is adapted.

Fig. 4 is a wiring diagram showing a method of furnace control adapted to the invention.

Fig. 5 is a fragmentary view showing a modification of the invention, in which a solenoid replaces the resistance-heated warp element.

This invention is an improvement over the form of float valve control illustrated and described in copending application, Serial Number 82,869, filed June 1, 1936, now Patent No. 2,143,277 granted Jan. 10, 1939, Figs. 9 and 10, in which the attachment operates directly on the reset and release levers of the valve, and also over that shown in Figs. 1, 3 and 4 of that application, in which only the inlet valve is controlled, while this invention controls both, the admission valve and the metering valve, and does not interfere with the usual functioning of the valves for closing and merely delays the opening.

Also, the warp thermostat element described and claimed in copending application, Serial Number 614,412, filed May 31, 1932, for Electric valve, now Patent No. 2,118,443, granted May 24, 1938, is well suited for use in conjunction with this invention, as is also the warp element illustrated and described in the first mentioned application.

This invention is an attachment for use with standard types of fuel flow controls, and may be incorporated directly into a float valve control unit if desired, and is illustrated as applied to one form of standard float valve consisting of a fuel chamber 10 having a safety-float chamber 11 in which a float 12 operates when oil overflows the dam 13, such as would occur in case the fuel admission valve failed to close. A latch lever 14 has one end pivotally connected to the float 12 as indicated at 15, and is pivotally mounted adjacent its other end as indicated at 16 to the housing 10 and terminates in a release lever 17 which extends through the wall of the housing for finger release, and also has a depending latch 18 which is cooperatively related to a lug 19.

The lug 19 is integral with an admission valve closing lever 20 which has a finger extension 21 for resetting the lever 20 for releasing the

admission valve for opening, and is pivoted to the housing at its other end as indicated at 22, and a compression spring 23 acts between the abutment 24 formed on the housing, and a shoulder 25 formed on lever 20, the spring acting to thrust the lever 20 down.

An admission valve 26 having a stem 27 is normally resiliently maintained open through the medium of a leaf spring 28 lifting on a pin 29 which is fixed in the stem 27, this spring being fixed to one end of a lever 30 which is pivoted intermediate its ends at 31 in a bracket 32 mounted in the housing 10, the other end of the lever having a float 33 attached thereto, and a metering valve 34 is normally manually adjusted from the top of the housing, this manual control being removed for use of this invention.

Thus, when the housing 10 is empty, and levers 14 and 20 are set as shown, valve 26 is open, and when the flow of oil from supply is released, it flows into chamber 10, raising float 33 which closes the valve after a predetermined level is reached. If the valve should fail to close properly, increase in fuel level will overflow the dam 13, raise float 12 and release latch 18 from lug 19, and spring 23 then forces lever 20 down, engaging the top of the stem 27 and closing the admission valve tightly to prevent further ingress of fuel.

The parts so far described are standard and do not form a part of the invention.

The invention consists of an attachment consisting of a housing 35 having a cover 36, and which housing is mounted on top of the cover 37 of housing 10, and a bottom 38 is formed in housing 35 in spaced relation to the cover 37.

A thermo-warp element, consisting of two bi-metal leaves 39 and 40 with a resistance unit 41 sandwiched therebetween, is fixedly mounted on a pedestal extending up from the bottom 38 as indicated at 42, and suitable terminals 43 are provided for the terminals of the heating resistance 41.

An adjusting screw 44 is mounted in the free end of the warp element, and a bracket 45 is also secured to the free end of the warp element, and to which bracket is secured an arm 46 on which a mercury switch 47 is mounted for adjustment on, and relative to the arm as shown, a suitable insulated passage 48 being provided for the terminals 49 of the mercury switch.

A hinge bracket 50 is also secured to the end of the warp element, as by the screw 44, and a latch 51 having an engaging shoulder 52 and release shoulder 53 and a head 54 is pivotally mounted on bracket 50 and extends through an opening in the cover 36, as shown. The shoulder 52 is so located that it will catch on the cover to support the warp element in partly warped condition, but not to the full extent of the warp created by the resistance heating element.

A metering valve plunger 55 is provided with an adjustable head 56 and is urged to normally open the metering valve 34 by means of a compression spring 57, which acts between the top of the cover 27 or a pocket formed therein, and the disc 58.

Metering means for the valve for high and low fire consists of a head 58 which is fixedly mounted in the housing 35 as indicated at 59 and provided with a passage 60 for the threaded extension 61 of the metering valve stem 55, and with an adjusting screw 62 for cooperation with the disc 58. Low flame adjustment is obtained by adjustment of nut 63 on extension 61, and high

flame adjustment is obtained by adjustment of screw 62.

The control for the admission valve 26 consists of a plunger 64 which passes through a hole 65 formed through the lever 20 with the lower end of the plunger cooperatively related to lever 30 and urged away therefrom by a compression spring 66 which acts between the cover 37 and a disc 67 formed or mounted at the upper end of plunger 64, this plunger reciprocally operating in a bearing 68 secured to or formed in the cover 37, and the disc 67 has an extension 69 terminating in a head 70. A screw 71 is threadably secured in the disc 67 for adjustment to prevent closing of the admission valve when the high-low adjustments of the metering valve are used.

An equalizing crossbar 72 has its opposite ends respectively cooperating with the disc 56 and disc 67, and intermediate its length cooperates with the adjusting screw 44.

The wiring diagram shown in Fig. 4 is a modification of the wiring diagram shown in the first mentioned copending application which includes the room thermostat 73, time delay relay 74, micro-switch 75, operating thermostat 76, transformers 77 and 78, igniter 79, burner 80, and main line wires 81 and 82.

The modification consists of the new control arrangement including the valve plungers 64 and 55 for the respective admission and metering valves and the equalizing cross arm 72, mercury switch 47 which controls operation of a forced draft fan or booster motor 83 for induced draft in the furnace, the only variation in wiring from the previously mentioned wiring diagram consisting in the connection 84 from one power line 82 to switch 47, a connection 49 from switch 47 to motor 83, and a connection 85 from line 81 to motor 83.

The operation of the attachment and control valve is as follows:

The normal relation of parts is; warp element 39-40-41 cold and deflected down, overcoming the tension of springs 57 and 66 and closing both valves 34 and 26 by depressing lever 30, and levers 14 and 20 set and latched as shown, and switch 47 open. If too much oil enters chamber 10 and flows over dam 13, trigger 18 will be tripped and lever 20 will add its force to close valve 26, therefore the invention does not interfere with the normal operation of the trip.

When the circuit is completed through the room thermostat 73, a circuit is completed through wire 86, heating resistance 41 and wire 87 and the thermo-warp element 39-40 begins to warp upwardly to a position shown in Fig. 1, releasing both valves 26 and 34 to open very slowly, at the same time tilting the mercury switch 47 to close circuit through wires 84, 49, motor 83 and wire 85 to the main line wires 81 and 82, starting the fan or forced draft motor 83 into operation.

When the circuit through resistance 41 is broken by the room thermostat, the warp element slowly retracts as it cools, slowly closing the valves, and after a predetermined period, depending on the adjustment of the switch on arm 46, the circuit to motor 83 is broken, thus permitting the motor to operate for a while after the circuit is broken to the resistance 41 to complete combustion of the fed fuel.

The valves may be caused to operate for initial opening in sequence by either varying the tension of the two springs, or by having screw 46 cooperate at a point off center on the cross arm 72, closer to one valve stem than to the other,

and is preferably adjusted to open the admission valve in advance of the metering valve.

If the device is to be operated for high-low fire, nut 63 is adjusted to the position for the desired low, and screw 62 is adjusted for the desired high, and screw 71 is adjusted down to keep valve 26 constantly released to open.

Under such conditions the warp element has no effect on valve 26 at any time, and the metering valve lifts only as far as the screw 62 will permit and will be depressed only as far as nut 63 will permit, therefore sufficient opening is provided for constant low fire and the valve is permitted to open only very slowly when changing from low to high or from high to low.

In the event that current should be interrupted, the latch 51 is provided so that the valves can be released to open by pulling up this latch and catching the shoulder 52 on the edge of the opening through which it passes, this shoulder being so located that it will sustain the warp element at a value below the maximum warp creatable by the heating resistance, therefore, when current is re-established, further warp of the element will cause the inclined shoulder 53 to ride on the edge of the opening and force the latch back to clear, thus being automatically releasable, or, a spring 88 may be employed to throw the latch back to clear when the warp element warps sufficiently to release the latch.

The arrangement described operates to release the valves to open very slowly and to close them slowly, and is absolutely quiet in operation, and is therefore preferred over the magnetic type fragmentarily shown in Fig. 5, in which a solenoid 89 has its core 90 attached to the cross arm 72.

With this magnetic type of actuator, the opening and closing of the valves is instantaneous and abrupt, and in addition to the snap report each time the solenoid operates to either retract or release, there is also, with alternating current, the constant hum while the solenoid remains energized. This noise is all obviated by the use of the warp element, and a distinct advantage is secured thereby.

It will be understood that variations in construction and arrangement of parts, which variations are consistent with the appended claims, may be resorted to, without detracting from the spirit or scope of the invention, or sacrificing any of the advantages thereof.

I claim:

1. In a float valve control having an admission valve and a float controlling said admission valve; a metering valve and a spring normally urging said metering valve to open; a thermo-warp element cooperatively related to said valves and maintaining said valves in closed position against the respective actions of said float and said spring when said warp element is cold and slowly releasing said valves to open when said warp element becomes heated.

2. A structure as claimed in claim 1, and spanning compensating means pivotally cooperating between said valves and with said thermo-warp element to insure complete closing of both valves by said thermo-warp element and controlling said valves for sequential operation.

3. A structure as claimed in claim 1, spanning compensating means pivotally cooperating between said valves and intermediately with said warp element effecting complete closing of both valves by said warp element and controlling said valves for sequential operation, and adjusting means

coincidentally forming the pivotally cooperative means and comprising a screw mounted in said thermo-warp element for adjusting the closing tension on the valves as applied through said warp element.

4. A structure as claimed in claim 1, and a cross arm having its ends associated with said valves and cooperating intermediate its length with said thermo-warp element creating sequential initial release of said valves to open as said thermo-warp element becomes heated.

5. A structure as claimed in claim 1, and means associated with said admission valve and having a screw adjustable at will to maintain said admission valve released to open when said thermo-warp element is cold, and means cooperatively related to said metering valve and adjustable at will limiting the degree of opening of said valve; and means associated with said metering valve and adjustable at will limiting the degree of closing of said metering valve.

6. A structure as claimed in claim 1, a cover; and latch means associated with said thermo-warp element and operating through and adapted to engage said cover for manually warping said warp element to release said valves to open when said warp element is cold, and cam means formed on said latch means releasing said latch means through cooperation with said cover for normal functioning of said warp element after said warp element has been heated to a predetermined degree.

7. In a float valve control having a float controlled admission valve and a metering valve; a plunger cooperatively related to each valve; a thermo-warp element cooperatively associated with said plungers and having a heating resistance and a circuit therefor; a lift spring associated with each plunger and normally urging release of said valves to open; said plungers being urged by said thermo-warp element to close said valves when said thermo-warp element is cold, said thermo-warp element slowly releasing said plungers to release said valves as said thermo-warp element is heated by said resistance upon completion of said circuit and slowly urging said means to close said valves when said circuit is interrupted.

8. A structure as claimed in claim 7, and a cross arm having its ends cooperating with said plungers and cooperating intermediate its length with said thermo-warp element for effecting suitable closing of both valves and providing sequential release of the valves in accordance with the relative tension of said springs.

9. A structure as claimed in claim 7, a cover for said control; and latch means manually accessible and associated with said thermo-warp element and adapted to engage said cover for manually warping and securing said warp element in a condition of warp to predetermined degree, and cam means associated with said latch means releasing said warp element for normal functioning after said warp element has been warped to a greater degree through the influence of said heating resistance.

10. In a float valve control having an admission valve and a metering valve; a control for said valves comprising a plunger cooperatively associated with each of said valves and a spring normally urging each plunger to release its associated valve to open; a thermostatic element cooperatively associated with said plungers and normally urging said plungers to close said valves; a cover for said control; and manually

operable latch means associated with said thermostatic element and engageably related to said cover for restraining said element when said latch means is engaged from urging said plungers; means for heating said thermostatic element and control means for said heating means; said manually operable latch means including cam means cooperatively related to said cover and automatically releasing said element for normal functioning when said thermostatic element has been influenced to a predetermined degree by said heating means and actuated through warping of said element under the influence of heat and cooperation with said cover.

11. A structure as claimed in claim 10; stop means adjustable to two positions and associated with the said plunger for said admission valve maintaining said plunger against urgency by said thermostatic element when in one position to maintain said admission valve release to open and permitting closing of the valve in the other position.

12. A structure as claimed in claim 10; stop means adjustable to two positions and associated with the said plunger for said admission valve maintaining said plunger against the urgency of said thermostatic element when said stop means is in one position to maintain said admission valve released to open and permitting closing of the valve when the stop means is in its other position; and movement limiting means associated with the plunger for said metering valve, and adjustable at will to limit said metering valve to predetermined degrees of opening and closing.

13. An electrical control for float valve controls having an admission valve and a metering valve; a plunger associated with each valve and a spring associated with each plunger urging said plungers to release said valves to open; a bi-metal thermo-warp element cooperatively associated with said plungers and having a heating resistance and a circuit therefor and a control for said circuit, and normally urging said plungers to close said valves, and slowly releasing said plungers to release said valves upon completion of said circuit; a cover for said control; manually controlled latch means operable at will and associated with said warp element and engageably related to said cover, for restraining said warp element from urging said plungers when said latch means is engaged with said cover and cam means associated with said latching means and cooperatively related to said cover to release said latch means after a predetermined move-

ment of said thermo-warp element following completion of said circuit, for subsequent normal functioning of said warp element.

14. A structure as claimed in claim 13; a cross arm pivotally associated intermediate its length with said warp element and terminally with said plungers, and thereby compensating for variations in necessary travel of the respective plungers to assure suitable closing of both valves and to permit opening and closing of the respective valves in sequential relation.

15. A structure as claimed in claim 13; compensating means comprising a cross arm pivotally associated intermediate its length with said warp element and terminally cooperating with said plungers compensating for variations in necessary travel of said plungers to insure suitable closing of both valves and to permit opening and closing of the respective valves in sequential relation; stop means associated with the plungers for said admission valve and adjustable at will to two positions to prevent closing of said admission valve through the urgency of said warp element when in one position and to permit closing of said admission valve when said stop means is in its other position; and movement limiting means for the plunger for said metering valve and adjustable at will to limit opening of said metering valve to a predetermined degree and for limiting closing of said metering valve under the urgency of said warp element to a predetermined degree.

16. A float valve control comprising a housing; a thermo-warp element and a heating resistance therefor and a circuit for said heating resistance, said thermo-warp element being secured by one of its ends to said housing, and having an adjustable screw mounted at the other of its ends; a plurality of spaced-apart plungers each associated with a valve, and a lift spring for each plunger; a cross-arm intermediately cooperating pivotally with said screw and terminally cooperating with the respective plungers; a screw adjustably associated with one of said plungers and adjustable at will to a position to prevent depression of said plunger under the influence of said warp element; and plural adjusting means for another of said plungers and adjustable at will for respectively limiting the lifting of the plunger to a predetermined degree under the influence of its lift spring and to limit the depression thereof to a predetermined degree under the influence of said warp element.

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