April 27, 1937. P. S. ARNOLD 2,078,305

AUTOMATIC OIL BURNER CONTROL

Filed May 14, 1936 2 Sheets-Sheet 1

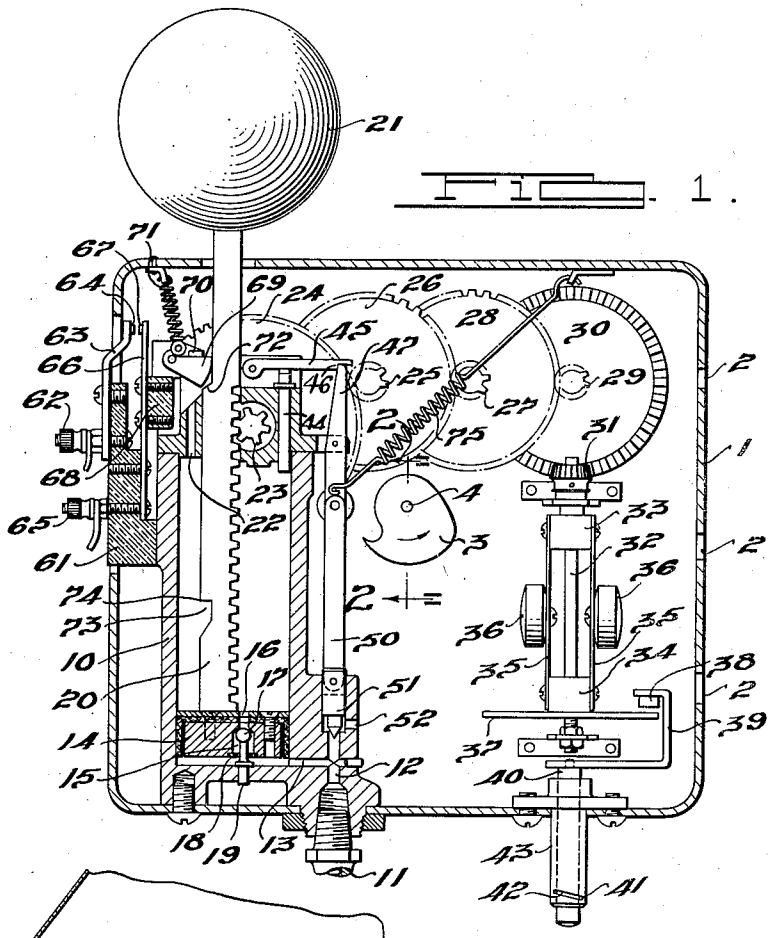

FIG. 1.

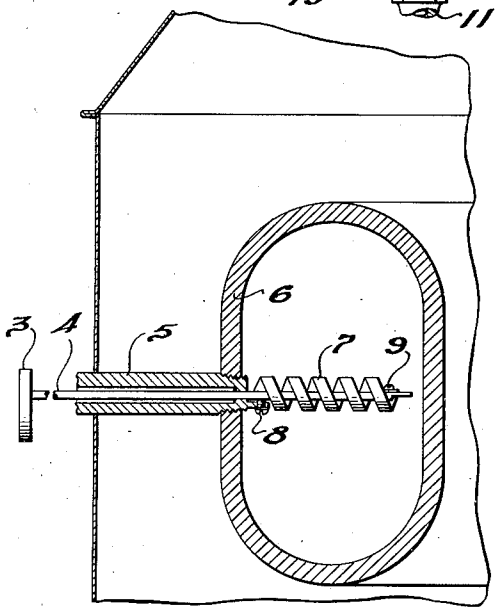

FIG. 2.

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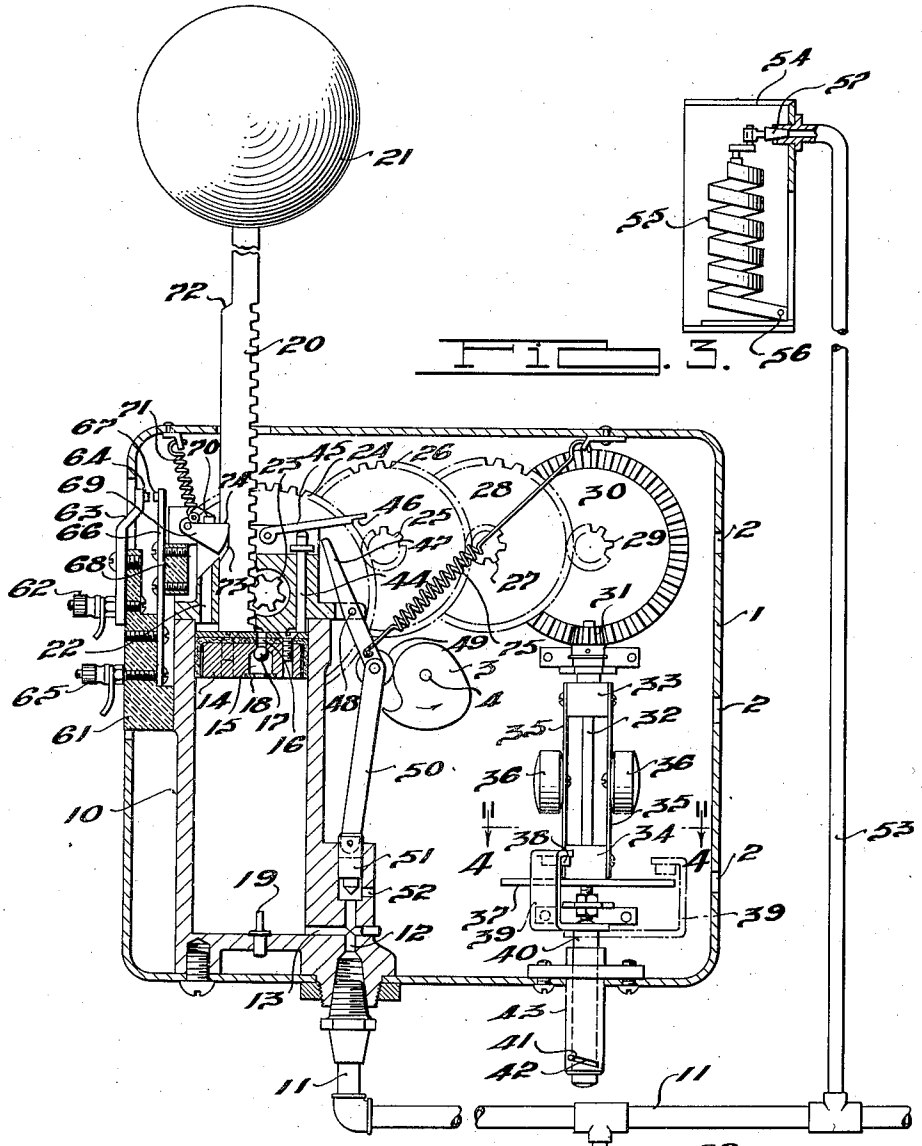

Fig. 3.

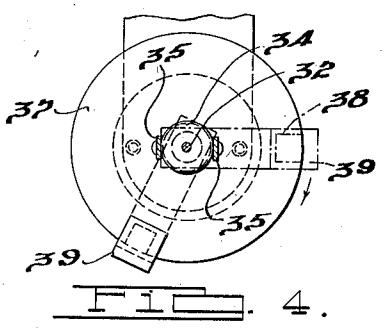

Fig. 4.

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AUTOMATIC OIL BURNER CONTROL

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6 Claims. (Cl. 236—79)

This invention relates to oil burner controls and the object of the invention is to provide a control for an oil burner arranged to provide a time interval for ignition of the oil and also arranged to shut off the oil and ignition in case the oil does not ignite.

A further object of the invention is to provide an automatic control which will automatically shut off the oil supply if the fire should go out.

Another object of the invention is to provide an automatic control for an oil burner having a cycling movement to provide a time interval during ignition of the oil and having a re-cycling movement upon shut off or failure of the oil burner.

A further object of the invention is to provide a governor for timing both the cycling and re-cycling movements to provide a proper time interval.

Another object of the invention is to provide an automatic oil burner control arranged to provide ignition for the oil during the cycling movement only.

These objects and the several novel features of the invention are hereinafter more fully described and claimed and the preferred form of construction by which these objects are attained is shown in the accompanying drawings in which—

Fig. 1 is a section through an automatic oil burner control comprising my invention at the beginning of the cycling movement.

Fig. 2 is a section taken on line 2—2 of Fig. 1 and showing the furnace thermostat.

Fig. 3 is a view similar to Fig. 1 showing the parts in position taken when burner fails to ignite.

Fig. 4 is a section taken on line 4—4 of Fig. 3.

As shown in Figs. 1 and 3 the device comprises a casing 1 having apertures 2 therein open to atmosphere. In the casing 1 is a cam 3 mounted on a shaft 4. This shaft 4 is shown more particularly in Fig. 2 and extends through a tube 5 into the radiator ring 6 of a warm air furnace. A coiled bimetallic element 7 is anchored at one end to the stationary screw 8 and at the opposite end is connected to the end of the shaft 4 by the screw 9. This bimetallic element 7 is arranged with the high expansion metal on the inside so that upon increase of temperature the cam 3 shown in Figs. 1 and 3 is turned in a counter-clockwise direction as indicated by the arrow.

A cylinder 10 is provided in the casing 1 and an air conduit 11 is connected to one side of the cylinder 10 so that air may flow through the channels 12 and 13 into the interior of the cylinder beneath the piston 14. This piston 14 is provided with a recess 15 having a discharge opening 16 and a ball 17 is positioned in this recess and retained in the recess by means of a perforated retainer plate 18. A pin 19 is mounted in the bottom of the cylinder and when in the position shown in Fig. 1 the ball 17 seats on the upper end of the pin 19 and the weight of the piston rests on the ball 17 which closes the opening 16.

Connected to the piston 14 is a rack 20 provided with the usual rack teeth and the upper end of this rack extends through the top of the casing and is provided with a weight 21 on the upper end thereof exteriorly of the casing. At the top the cylinder is provided with an air discharge opening 22 and a pinion 23 meshes with the teeth on the rack 20. The shaft of this pinion is connected to the gear 24 which in turn meshes with a smaller gear 25 connected to a gear 26 and the gear 26 meshes with a smaller gear 27 which is connected to a larger gear 28. The gear 28 meshes with a smaller gear 29 to which the beveled gear 30 is connected and this beveled gear 30 meshes with a beveled gear 31 on the vertical shaft 32.

Secured to the shaft 32 is a block 33 and slidably mounted on the shaft 32 is a second block 34. The blocks 33 and 34 are connected by thin spring metal strips 35 to which weights 36 are secured and it is also to be noted that the disc 37 is connected to the block 34 and may move longitudinally of the shaft 32 with the block 34.

Should air under pressure be delivered into the cylinder 10 beneath the piston 14 this piston is raised to move the rack upwardly toward the position shown in Fig. 3. This movement of the rack rotates the piston 23 and through the gear chain rotates the gear 31 and shaft 32. During rotation, the weights 36 move outwardly by centrifugal force thus raising the block 34 and disc 37 until it contacts the shoe 38 on the arm 39.

This arm 39, as shown in Figs. 1 and 4, is connected at the inner end to a shaft 40 which is in vertical alignment with the shaft 32 and the shaft 40 carries a pin 41 riding in the angular slot 42 in the stationary tube 43 in which the shaft 40 is rotatable. As the disc 37 moves into engagement with the shoe 38 the arm 39 is turned in a clockwise direction indicated by the arrow in Fig. 4 and this moves the pin 41 up the inclined slot 42. This raises the shoe 38 to the position shown in Fig. 3 so that the gov-

ernor can attain its maximum speed of rotation thereby allowing the piston 14 and rack 20 to complete the upward travel without further restriction.

As the piston 14 reaches the end of its upward travel it engages the pin 44 on which the pivoted arm 45 rests. This arm is provided with a shoulder 46 against which the end of an arm 47 normally engages as shown in Fig. 1. This arm 47 is pivoted at 48 and at the lower end carries a roller 49 which is in the same plane as the cam 3. Also pivotally connected to the arm 47 is an arm 50 which is pivotally connected in turn to a valve 51. This valve 51 is slidably mounted in a chamber provided at one side of the cylinder 10 as shown and when raised to the position shown in Fig. 3 will allow air to flow from the conduit 11 thence through the conduits 12 and 52 to discharge to atmosphere. The conduit 11 shown in Fig. 3 is connected to an air pump (not here shown) having a continuous and constant output and a conduit 53 is connected to the conduit 11 and allows flow of air upwardly to a room thermostat 54.

This room thermostat 54 is shown in order to simplify the explanation of the operation of the device and in actual operation a room thermostat control is utilized similar to that shown in my co-pending application on Oil burner control. The essential parts necessary for proper operation comprise a thermostat coil adapted to open or close the conduit 53 and the thermostat coil is preferably arranged to move to a full open position or a full closed position upon thermostat variation so as not to assume an intermediate leaking position.

To simplify the explanation and drawings, a thermostat coil 56 is shown secured to the housing 54 at the point 56 and is connected at the upper end to a valve 57 which closes off the air conduit 53 when the room temperature is below the desired point and this thermostat coil 55 is also arranged to open the valve 57 when the room temperature is at or above the desired point. Also, connected into the conduit 11 is a diaphragm valve 58 which under air pressure will open the valve 59 in the oil feed line 60 and upon decrease of pressure will close the said valve and shut off the oil to the burner.

Mounted on one side of the cylinder 10 is an insulating block 61 shown in Figs. 1 and 3 and this insulating block is provided with an electric terminal 62 connected to a contact arm 63 having a contact point 64. The other electric terminal 65 is connected to a spring contact arm 66 having a contact point 67. Also secured to the arm 66 is an insulating block 68 carrying a pivoted pawl 69 arranged to engage the stop 70 against which it is urged by the spring 71.

With the parts in the position shown in Fig. 1 at the beginning of the cycling movement the shoulder 72 on the rack 20 will engage the rounded face of the pawl 69 and force it to the left of Fig. 1 as the rack 20 moves upwardly. This will move the contact point 67 into engagement with the contact point 64 and complete the electric circuit for igniting the oil, the ignition circuit being connected to the electric terminals 62 and 65.

These points are held in contact until the notch 73 of the rack comes opposite the pawl 69, at which time the pawl will assume the position shown in Fig. 3 allowing the contact point 67 to move out of engagement with the contact point 64. On the re-cycling movement in which the piston moves downwardly from the position shown in Fig. 3 to that shown in Fig. 1 the shoulder 74 at the top of the notch 73 merely turns the pawl 69 downwardly on its pivot against the tension of the spring 71 without moving the contact points into engagement and when the piston has moved to the bottom of its stroke the pawl will re-assume the position shown in Fig. 1 under action by the spring 70.

In Fig. 1 the parts are shown in position for operation and it is necessary at this time that the room be below the desired temperature so that the valve 57 in the room thermostat 54 is closed and the valve 51 on the side of the cylinder 10 is also in closed position to prevent leakage of air anywhere in the air conduits. As the system is supplied with an air pump having a continuous and constant output the pressure will begin to build up in the air conduit and in the diaphragm valve 58 thus opening the oil valve 59.

This air pressure will also be applied beneath the piston 14 to raise the piston and it is to be noted that this air pressure is sufficient to hold the ball 17 against its seat. As the piston 14 and rack 20 begin the upward movement the contacts 64 and 67 are brought together to provide ignition for the oil flowing through the conduit 60 and the governor operated by the rack and pinion controls the upward movement of the piston 14.

In normal operation during this governed upward travel or cycling movement the oil is ignited in the oil burner and begins to heat up the radiator ring 6 of the warm air furnace. As this begins to heat the thermostatic element 7 shown in Fig. 2, turns the cam 3 in a counter-clockwise direction so that the high portion of the cam 3 engages the roller 49 on the arm 48. At this time when the piston reaches the upper end of its stroke it lifts the pin 44 and arm 45 but the high point of the cam 3 contacting the roller 49 at this time prevents turning of the arm 47 on its pivot and the arm 47 will thus remain in position to be reengaged by the shoulder 46 when the pin 44 is lowered. It is also to be noted that as the piston reaches the top of its stroke the pawl 69 moves into the notch 73 in the rack 20 and thus breaks the ignition circuit. The burner will then continue in normal operation until the room temperature becomes sufficient to operate the room thermostat 55 and open the valve 57. At this time the air will escape through the valve 57 reducing the pressure in the cylinder 10 and allow the piston 14 to move downwardly by action of the weight 21 and controlled by the governor through the rack and pinion. In this connection it will be noted that the governor will be rotated in the opposite direction to that during upward movement of the rack. This results in the movement of the arm 39 from the position shown in Fig. 3 back to the position shown in Fig. 1 with the pin 41 at the lower end of the angular slot 42.

As the piston 14 moves downwardly the pin 44 returns to the position shown in Fig. 1 and the arm 45 returns to position on the upper end of the arm 47 so that the upper end of the arm engages behind the shoulder 46. By the escape of air from the system the diaphragm valve 58 closes the oil valve 59 and the ball 17 drops from its seat by reduction of pressure and is re-seated when the piston reaches the bottom of its stroke by the pin 19 which again lifts the ball to position to close the air relief aperture 16. During this downward movement of the rack 20, the

pawl 69 is turned on its pivot and is held against the flat side of the rack 20 by the spring 71 so that during this re-cycling movement the electrical contacts are not brought to engagement. As the furnace cools down, the thermostat 7 turns the cam 3 in a clockwise direction back to the position shown in Fig. 1, at which time, the device is ready for a successive operation.

If on the successive cycling operation the oil fails to ignite, there is no heat produced in the radiator ring 6 of the furnace and consequently the cam 3 remains in the position shown in Fig. 1. If the cam 3 is in this position when the piston 14 reaches the top of its stroke, the pin 44 raises the arm 45 allowing the spring 75 to turn the arm 47 on its pivot sufficiently to bring the roller 49 into contact with the cam 3 as shown in Fig. 3. This opens the valve 51 and allows the air to escape from the system through the aperture 52 thus allowing the piston 14 to return to the bottom of the cylinder to the position shown in Fig. 1 but in this instance it is necessary to manually re-set the pivoted arm 47 against the shoulder 46 of the cam 45 to re-establish operation.

After the cycling movement and with combustion going on properly in the burner, if the fire should go out, the bimetallic element 7 will cool and rotate the cam 3 so that its low side will be presented to the roller 49 on the arm 47 and the spring 75 will draw the arm 47 over to the position shown in Fig. 3 to open the valve 52 and allow escape of air from the system thus shutting off the oil supply.

It is to be noted that the ball 17 is normally held against its seat by the air pressure beneath the piston 14. However, at any time the air pressure in the cylinder 10 is released or materially decreased by functioning or manipulation of the thermostat or otherwise when the piston 14 is not at the bottom of its stroke, the ball 17 will be allowed to drop to the retainer disc 18 and pressure cannot again be built up in the cylinder 10 or in the system until the piston 14 does reach the bottom of its stroke by re-cycling, thereby seating the ball 17 in its seat in the piston and preventing the air from escaping through the aperture 16 in the piston and through the upper part of the cylinder 10 and finally through the aperture 22 in the top of the cylinder. This feature is provided so that if the cycling movement is interrupted by manipulation of thermostat adjustment or otherwise, the piston 14 must return to the bottom of its stroke where a complete new cycling movement will begin thus giving the bimetallic element 7 an opportunity to function properly.

From the foregoing description it becomes evident that the device is very efficient in operation, will not easily get out of order, will automatically control the oil burner under all operating conditions and provides a device which accomplishes the objects described.

Having thus fully described my invention, its utility and mode of operation, what I claim and desire to secure by Letters Patent of the United States is—

1. In an automatic oil burner control, a cylinder, a piston slidably mounted therein, an air supply conduit opening into the bottom of the cylinder, the arrangement allowing the piston to move upwardly in the cylinder under air pressure, a rack connected to the piston, a weight secured to the rack and tending to move the piston toward the bottom of the cylinder, a pinion meshing with the rack, a governor operated by rotation of the pinion to control movement of the piston, a vent valve arranged to allow escape of air from the bottom of the cylinder when opened, a trip mechanism arranged to normally hold the vent valve in the closed position, a thermostat, a cam connected to the thermostat and turnable thereby, the cam in one position preventing tripping of the trip mechanism and when in the other position allowing the trip mechanism to be tripped by the piston on reaching the upper end of the cylinder, the upper end of the cylinder and the piston being each provided with a vent aperture, a ball arranged to close said piston aperture, the ball being supported on its seat by air pressure in the cylinder, said ball being arranged to drop from its seat upon reduction of air pressure in the cylinder beyond a predetermined point, means for re-seating the ball as the piston reaches the bottom of the cylinder, an ignition switch, a pawl for operating the switch, the pawl riding in engagement with the side of the rack and arranged upon upward movement of the rack to close the ignition switch, said pawl being turnable out of operating position by downward movement of the rack.

2. In an automatic oil burner control, a cylinder, a piston slidably mounted therein, an air supply conduit opening into the bottom of the cylinder, the arrangement allowing the piston to move upwardly in the cylinder under air pressure, a rack connected to the piston, a weight secured to the rack and tending to move the piston toward the bottom of the cylinder, a pinion meshing with the rack, a governor operated by rotation of the pinion to control movement of the piston, a vent valve arranged to allow escape of air from the bottom of the cylinder when opened, a trip mechanism arranged to normally hold the vent valve in the closed position, a thermostat, a cam connected to the thermostat and turnable thereby, the cam in one position preventing tripping of the trip mechanism and when in the other position allowing the trip mechanism to be tripped by the piston on reaching the upper end of the cylinder, the upper end of the cylinder and the piston being provided with vent apertures, a ball arranged to close said piston aperture, the ball being normally supported on its seat by air pressure in the cylinder, said ball being arranged to drop from its seat upon reduction of air pressure in the cylinder beyond a predetermined point and means for re-seating the ball as the piston reaches the bottom of the cylinder.

3. In an automatic oil burner control, a cylinder, a piston in the cylinder, a conduit opening into the bottom of the cylinder, the conduit being provided with a continuous air supply at a constant volume, a valve for venting said conduit to atmosphere, a toggle joint connected to the valve, a spring tending to turn the toggle joint to open the valve, a latch normally holding the toggle joint in position to maintain the valve in closed position, a thermostat, a cam on the thermostat, the thermostat when heated turning the cam to position to prevent movement of the toggle joint under action by the spring, means for releasing the latch as the piston moves to the upper end of the cylinder, a rack connected to the piston, a weight supported on the rack and tending to move the piston downwardly, a governor and gear reduction means between the governor and the rack whereby movement of the rack is controlled and an ignition switch adapted to be closed by the rack upon upward movement thereof only.

4. In an automatic oil burner control, a cylinder, a piston slidably mounted therein, an air supply conduit opening into the bottom of the cylinder, the arrangement allowing the piston to move upwardly in the cylinder by air pressure, a rack connected to the piston, a pinion meshing with the rack, a governor operated by rotation of the pinion to control upward movement of the piston, a vent valve arranged to allow escape of air from the bottom of the cylinder, a trip mechanism arranged to normally hold the vent valve in the closed position, a thermostat, a cam connected to the thermostat and arranged to be turned by the thermostat, the cam in one position preventing tripping of the trip mechanism and when in another position allowing the trip mechanism to be tripped by the piston on reaching the upper end of the cylinder.

5. In an automatic oil burner control, a cylinder, a piston slidably mounted therein, an air supply conduit opening into the bottom of the cylinder, the arrangement allowing the piston to move upwardly in the cylinder by air pressure, a governor controlling upward movement of the piston, an ignition switch arranged to be automatically closed by upward movement of the piston, a vent valve arranged to allow escape of air pressure from the system, a trip mechanism arranged to normally hold the vent valve in the closed position, a thermostat, a cam connected to the thermostat and turnable thereby, the cam being arranged when in one position to allow the trip mechanism to be tripped by the piston on reaching the upper end of the cylinder.

6. In an automatic oil burner control, a cylinder, a piston slidably mounted therein, an air supply conduit opening into the bottom of the cylinder, the arrangement allowing the piston to move upwardly in the cylinder by air pressure, a governor controlling upward movement of the piston, an ignition switch for the oil burner arranged to be automatically closed during upward movement of the piston, a vent valve for venting the air pressure adjacent its entrance to the bottom of the cylinder, a trip mechanism adapted to be tripped by the piston on reaching the upper end of the cylinder, the trip mechanism being arranged to open the vent valve when tripped and a thermostatically operated cam arranged in one position to prevent movement of the trip mechanism to open the vent valve.

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