Dec. 6, 1949 A. F. CRAVER ET AL 2,490,729

FLASH IGNITION AND SAFETY CONTROL SYSTEM FOR GASEOUS FUEL BURNERS

Filed June 29, 1945 5 Sheets-Sheet 1

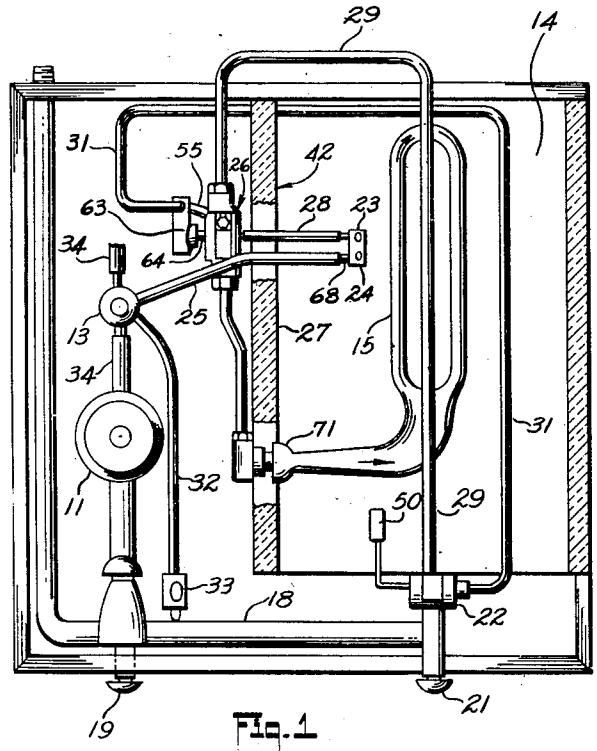
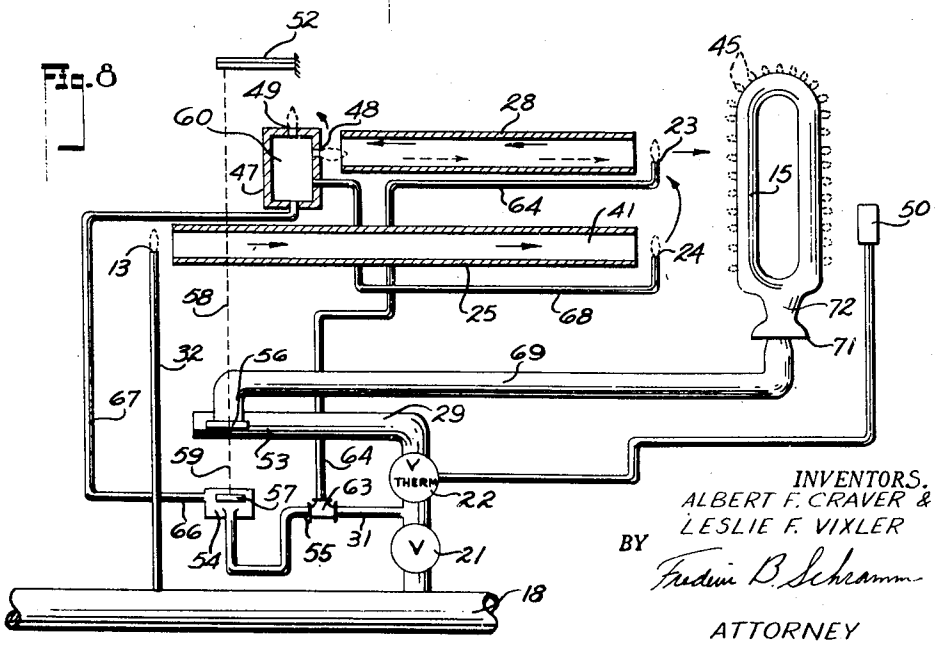


Fig. 1

Fig. 8



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FLASH IGNITION AND SAFETY CONTROL SYSTEM FOR GASEOUS FUEL BURNERS

Filed June 29, 1945 5 Sheets-Sheet 2

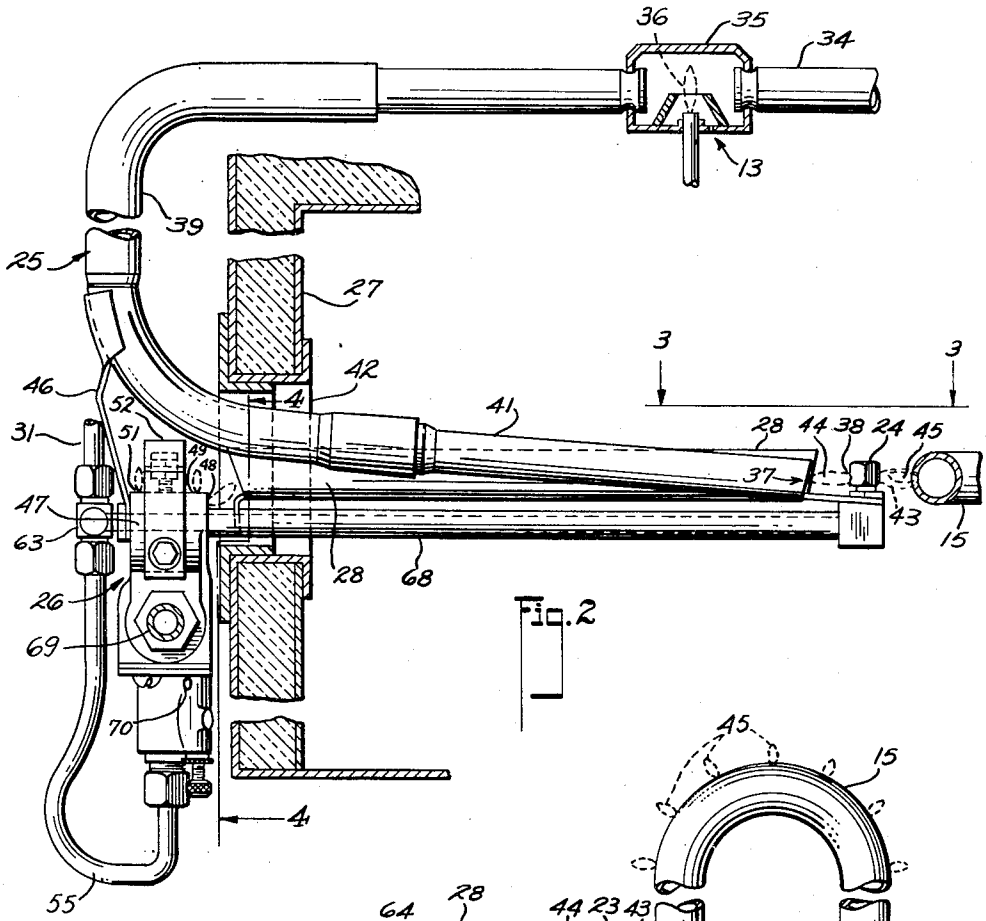


Fig. 2

Fig. 3

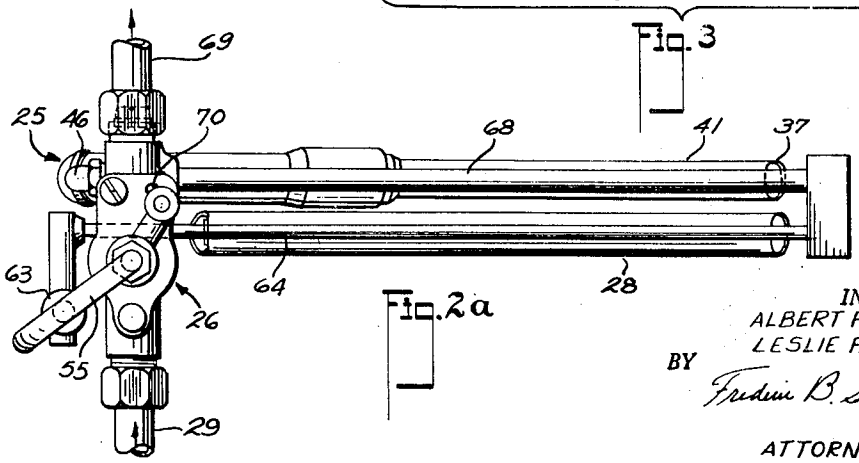


Fig. 2a

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FLASH IGNITION AND SAFETY CONTROL SYSTEM FOR GASEOUS FUEL BURNERS

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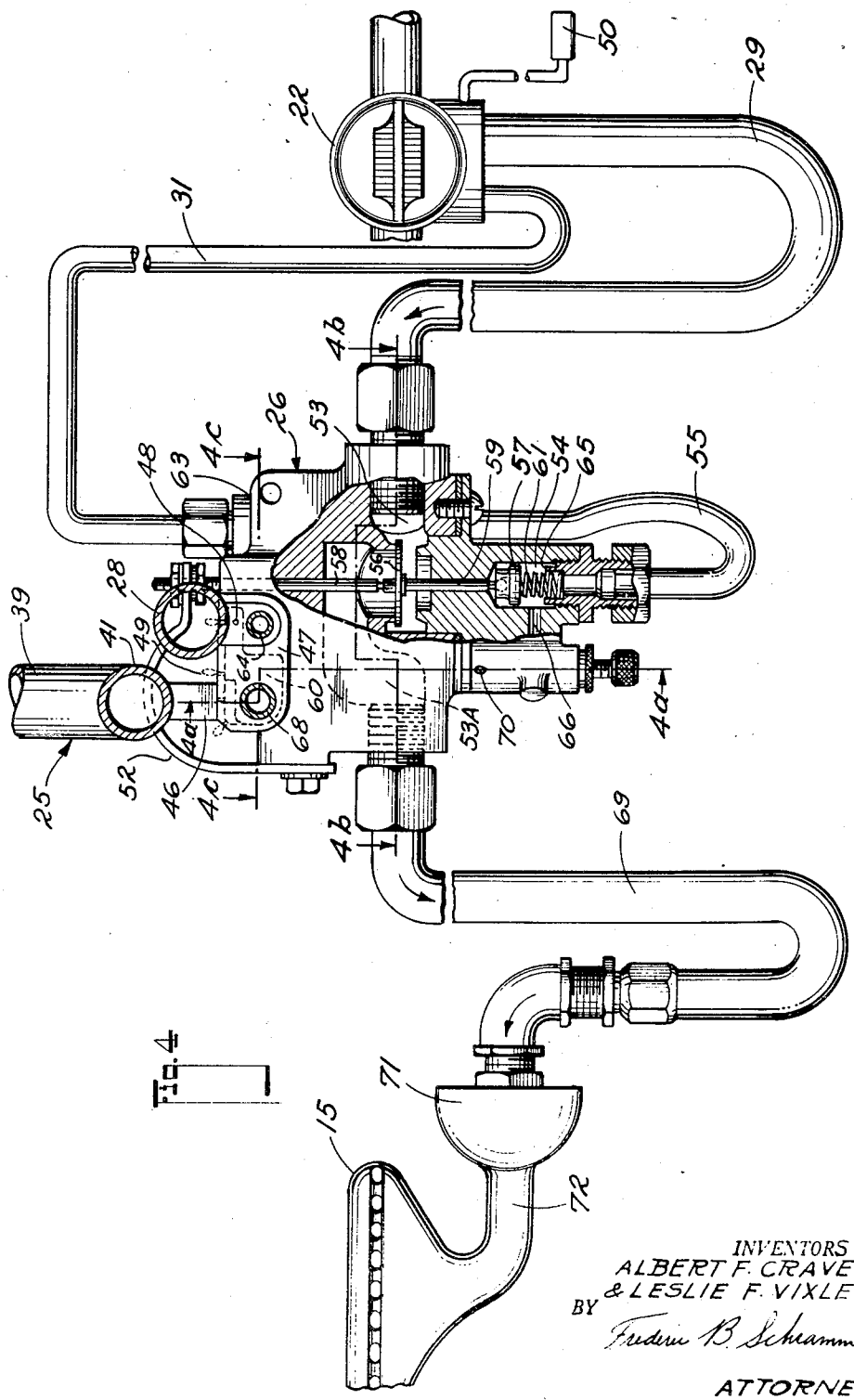


Fig. 4

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FLASH IGNITION AND SAFETY CONTROL SYSTEM FOR GASEOUS FUEL BURNERS

Filed June 29, 1945 5 Sheets-Sheet 4

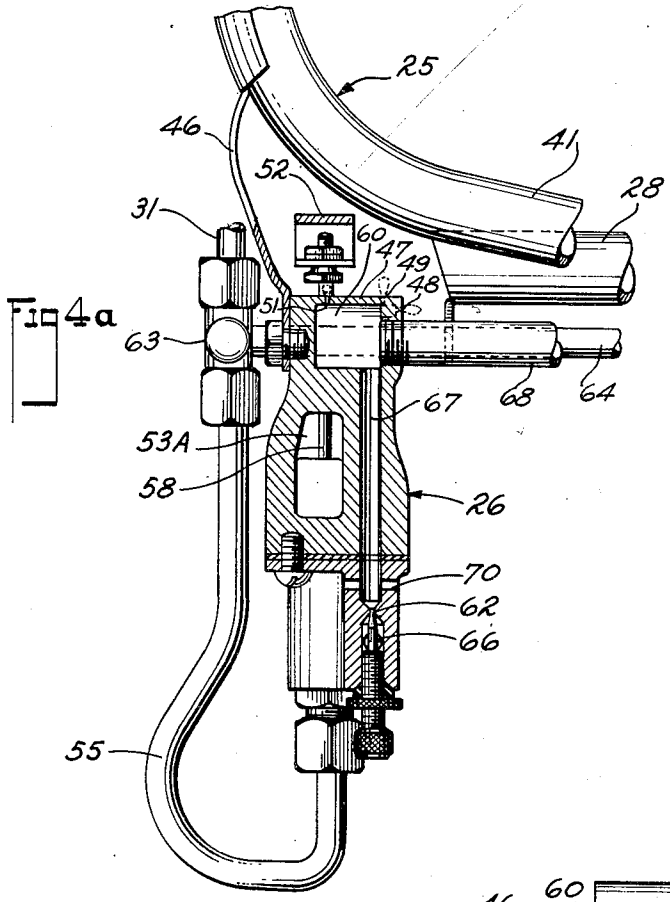


Fig 4a

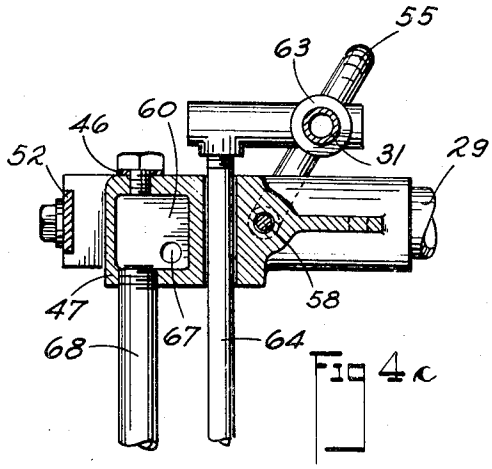


Fig 4c

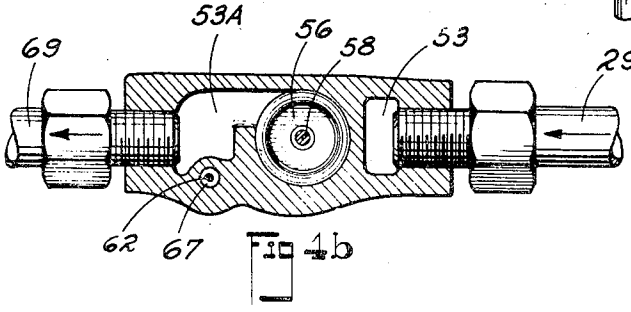


Fig 4b

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FLASH IGNITION AND SAFETY CONTROL SYSTEM FOR GASEOUS FUEL BURNERS

Filed June 29, 1945 5 Sheets-Sheet 5

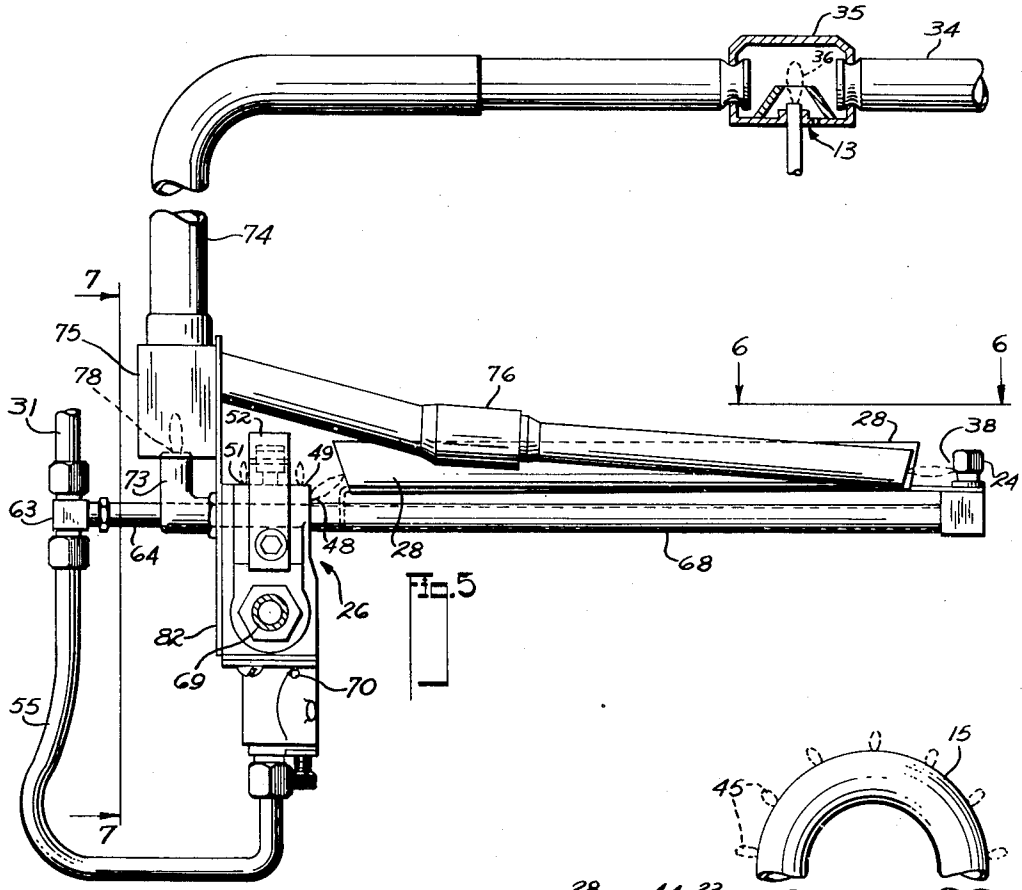


Fig. 5

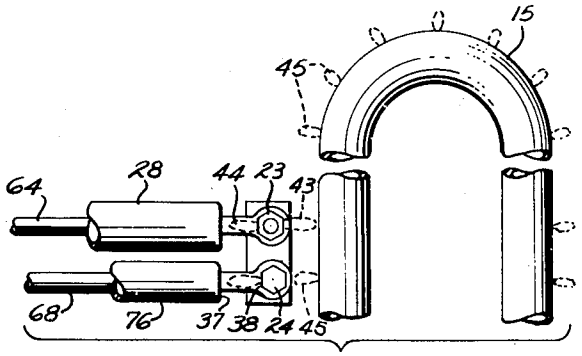


Fig. 6

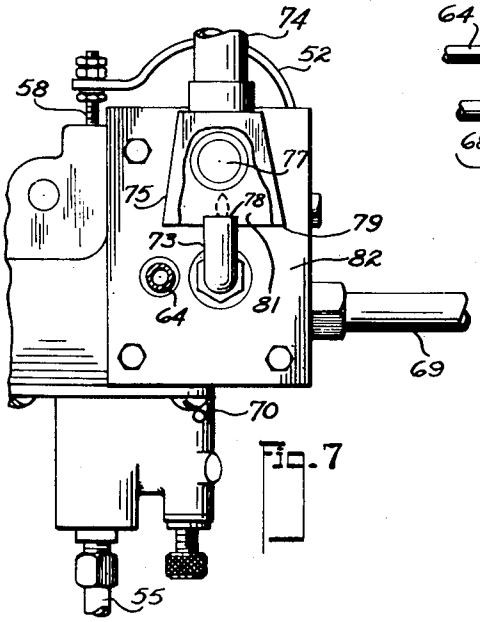


Fig. 7

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Patented Dec. 6, 1949

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UNITED STATES PATENT OFFICE

2,490,729

FLASH IGNITION AND SAFETY CONTROL SYSTEM FOR GASEOUS FUEL BURNERS

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Application June 29, 1945, Serial No. 602,360

5 Claims. (Cl. 158—117.1)

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Our invention relates to gaseous-fuel burner ignition and concerns both safety fuel-valve control systems and automatic fuel-valve control systems.

For the purpose of enabling gaseous fuel equipment such as kitchen ranges, for example, to be ignited automatically when the gas is turned on to a main burner, pilot lights have been employed. In order to ignite a burner from the pilot flame, tubes known as flash tubes have been provided which cause gas to be transferred from the burner to the pilot flame and cause a flame to be flashed back from the pilot through the flash tube to the burner for igniting it. A single top pilot has been employed for igniting all of the top range burners on the same level by utilizing separate flash tubes extending from the top pilot to the top burners. Ordinarily, however, a separate and remote pilot and a separate flash tube have been employed for igniting a remote burner or one at a different level such as the oven burner or the broiler burner, for example, where the oven or the broiler burner or the like was to be ignited automatically upon opening the gas valve. Since the oven or broiler burner is at a different level from the top burners in the standard kitchen range, the automatic ignition of the oven burner presents a different problem from the ignition of the top range burners where the top pilot is to be employed for automatic ignition of both. Considerable care is required to guard against flow of unignited gas from the oven burner in case of faulty action.

A similar problem is involved in deep-well top burners or any burner for a combustion chamber of a gas burning appliance remote from a pilot flame, or at a different level, including inaccessible enclosed burners. Even if a separate pilot is employed for the oven burner, e. g., considerable care is required to guard against flow of unignited gas from the oven burner in the event that the oven burner pilot should not be burning.

Accordingly, an object of our invention is to provide improved safe ignition systems for household ranges.

It is also an object of our invention to provide a system for igniting a flame in a combustion chamber of a gas-burning appliance which may be at a different level or remote from a constant burning pilot flame.

An object of our invention is to provide a system for igniting both top burners of a range and an oven or broiler burner from the same constantly burning pilot flame.

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Another object is to provide an ignition system for either igniting a main burner or a multiplicity of burners directly or through intermediate burners.

A further object is to provide an ignition system which eliminates danger of gas flow without ignition in the event of pilot flame extinction where a single constant burning pilot is required for a plurality of burners to be ignited.

Another object is to provide an ignition system with a plurality of supplemental or auxiliary pilot flames in which one flame may be flashed from another in either direction in the event of extinction of one of the flames.

Still another object is to provide for reduction in flame length of supplement pilots after they have accomplished their purpose and to provide for flow of gas to supplemental pilots only when a main burner is turned on.

Still another object is to prevent venting through a pilot-flashing tube.

Another object is to prevent concussion within a flash tube and to prevent interference with propagation of a flash or flame down a flash tube.

Other and further objects, features and advantages of the invention will become apparent as the description proceeds.

In carrying out the invention in a preferred form thereof, a separate ignition pilot is provided for a burner to be ignited such as an oven or broiler burner, which ignition pilot is adjacent to the oven or broiler burner and which is supplied with gas only when the oven or broiler gas valve is open. An initial flash pilot is provided for igniting the ignition pilot, and a flash tube is provided between the flash pilot and the constant burning conventional top pilot of the range for igniting the flash pilot from the top pilot when the oven burner valve is open.

A thermal safety valve control system is provided which is indirectly responsive to the existence of a flame at the ignition pilot for preventing the admission of gas to the oven burner or the broiler burner or other burner except when the ignition pilot is burning, and which serves also to graduate the ignition flash pilot to prevent passing products of combustion through the flash tube to the constant burning top range pilot after the ignition pilot and the oven or broiler burner or other burner have been ignited.

A better understanding of the invention will be afforded by the following detailed description considered in conjunction with the accompany-

ing drawing, and the scope of the invention will be set forth in the claims appended hereto.

In the drawing:

Fig. 1 is a top plan view, partially in section and with certain parts omitted, of a range having top burners and an oven burner with an ignition system in accordance with our invention;

Fig. 2 is a front elevation, partially diagrammatic, of a system for igniting an oven burner in the apparatus of Fig. 1; showing in part a wall of the oven;

Fig. 2*a* is a bottom view of apparatus shown in Fig. 2;

Fig. 3 is a fragmentary top view of a portion of the apparatus of Fig. 2, showing the ignition pilot and the initial flash pilot;

Fig. 4 is a side elevation, partially in section and partially distorted for clarity, showing especially gas lines and controlling arrangements, of the apparatus of Fig. 2 with a part of the apparatus of Fig. 1;

Fig. 4*a* is a view of a section of the apparatus represented as cut by a broken plane 4*a*—4*a* indicated in Fig. 4.

Fig. 4*b* is a view of a section of the apparatus represented as cut by a horizontal plane 4*b*—4*b* indicated in Fig. 4.

Fig. 4*c* is a view of a section of the apparatus represented as cut by a horizontal plane 4*c*—4*c* indicated in Fig. 4.

Fig. 5 is a front elevation corresponding to Fig. 2 of a modification of the arrangement of Fig. 2;

Fig. 6 is a fragmentary top view of a portion of the apparatus of Fig. 5, showing the graduated initial flash pilot and an ignition pilot;

Fig. 7 is a fragmentary side view of the apparatus of Fig. 5 illustrating the arrangement of a relay pilot; and

Fig. 8 is a schematic functional diagram of the arrangement of Figs. 1 to 4, showing gas lines and valve connections and relation of flash tubes to pilot burners.

Like reference characters are utilized throughout the drawing to designate like parts.

For the sake of illustration, there is shown in Fig. 1 a household or kitchen range having a plurality of top cooking burners 11 arranged to be ignited by a top pilot burner 13. It will be understood that the grates and a portion of the enclosing walls have been omitted for the sake of exposing the piping and burners to view. The range is represented as being of the type having a compartment 14 for an oven or broiler burner 15 which will be referred hereinafter for convenience as an oven burner.

For the sake of avoiding confusion in the showing of the oven burner 15, the range has been shown with all but one of the top burners 11 omitted and the pilot burner 13 displaced from a normal center position.

For supplying gas to the top burners 11 and the oven burner 15, a header or manifold 18 is provided, having branches with valves 19 interposed for manually controlling the gas supply to the top burners 11, and having a branch with a valve 21 interposed for manually opening the supply of gas to the oven burner 15 and to supplemental pilots employed in connection with the oven burner 15. Preferably, there is a thermostatic valve 22 for maintaining oven temperature at a pre-set value. A fixed flame-length pilot burner 23, which will be referred to as an ignition pilot is provided for igniting the oven burner 15, and a graduated flame pilot burner 24

which will be referred to as an initial flash pilot is provided for igniting the ignition pilot 23.

A flash tube 25, having one end lower than the other is provided for igniting the flash pilot 24 from the constantly burning top-pilot 13. It will be understood that the burners 11 are at the top of the stove whereas the burner 15 is within the compartment 14 below the top of the stove so that the burner 15 and the pilots 23 and 24 are at a lower level than the pilot 13 and the burners 11. Consequently, the flash tube 25 extends downwardly from the pilot 13 to the pilot 24. For preventing admission of gas to the oven burner 15 until after the ignition pilot 23 has been ignited, a safety gas valve control unit 26 is provided which is mounted outside the oven compartment 14, beyond the insulated oven wall 27 so as to be unaffected by the heat of the oven compartment 14. As will be explained more in detail hereinafter, the safety device 26 includes a thermal pilot burner communicating with the ignition pilot burner 23 through a substantially horizontal flash tube 28.

The valve 22 is provided with two outlets supplying a main line 29 for feeding gas to the oven burner 15 and a branch line 31 for supplying gas to the various supplemental pilots other than the constantly burning pilot 13. For supplying the constant top pilot 13, a line 32 is provided which is taken directly from the header 18 through an adjusting cock 33. Conventional top flash tubes 34 are provided for flashing the top burners 11 from the constant pilot 13 in the conventional manner. The valve 22 is of the type well known to those skilled in the art in which the outlet to the branch line 31 is fully opened whenever the outlet to the main line is partially or wholly opened. The outlet to the main line in such valves is opened and closed by a thermostatic bellows or the like (not shown) communicating with a bulb 50 mounted in the oven space 14.

The details of the oven burner igniting system will be more readily observed from Figs. 2, 3 and 4. Fig. 2 is primarily a view of the pilots and flashing arrangements, and Fig. 4 is primarily a view of the gas supply connections, and controls for various pilots and the oven burner.

As shown in Fig. 2 the constant burning top pilot 13 comprises a housing 35 enclosing the constant burning pilot jet 36. The flash tube 25 is fitted at the upper end into the housing 35 and extends downward with an open lower end 37 adjacent the initial flash pilot 24. As shown in Fig. 3 the pilot burner 24 has a side port 38 adapted to inject gas into the open end 37 of the flash tube 25. The flash tube 25 has a vertical arm 39 outside the oven wall 27 and a substantially horizontal lateral arm 41 extending through an opening 42 in the oven wall 27, from the vertical arm 39 to the flash pilot 24. Preferably, however, the lateral arm 41 is slightly sloping, making an angle of about 10° with the horizontal as shown, and slopes downward from the vertical arm 39 toward the flash pilot 24.

The ignition pilot burner 23 has two side ports producing side jets 43 and 44. The side jet 43, of a fixed length, extends toward the oven burner 15 for igniting the jets 45 extending around the oven burner. The second side port of the pilot 23 is for producing the fixed length jet 44, or for injecting gas into the horizontal flash tube 28 when the jet 44 is for some reason extinguished. The burner 23 is close enough to the burner 24 so that the jets 43 and 44 of the burner 23 are ignited from the jet 38 of the burner 24.

The safety valve control unit 26 is preferably mounted outside the oven wall 27 and may be supported in any suitable manner. By means of a strap 46, the vertical arm 39 of the flash tube 25 is located. The safety unit 26 includes a head 47 having a side port 48 and a plurality of top ports 49 and 51. The side port 48 is located to inject gas into the horizontal flash tube 28 for igniting a jet at the port 48 from the jet 44 of the ignition pilot burner 23 or vice versa. The arrangement is such that jets are ignited at the vertical ports or top ports 49 and 51 from the side jet at the port 48. A temperature-responsive movable member 52, such as a thermostatic bimetal strip, for example, is secured at one end to the safety control unit 26 is such position as to be exposed to the heat of the jets issuing from the top ports 49 and 51, which thus form a thermal pilot burner. The member 52 is provided with a linkage for controlling a valve graduating gas supplied to the ports of the unit 26 and the ports of the flash pilot 38 as will be explained more in detail hereinafter.

The safety control valve unit 26 as shown in Fig. 4 has two separate passageways 53 and 54 formed therein. The passageway 53 is connected to the main gas supply line 29 for the oven burner 15, and the passageway 54 is connected to a graduated-pilot supply line 55 for supplying gas to the ports 48, 49 and 51 of the unit 26 and to the port 38 of the initial flash pilot 24. A main line gas control valve, including a valve disc 56, is formed in the passageway 53, and a pilot graduating valve, including a valve disc 57 is formed in the passageway 54. A suitable linkage is provided between the valve discs 56 and 57 and the thermal responsive movable member 52. For example, the movable end of the member 52 may have a rod 58 secured thereto at one end and secured to the valve disc at the other end, and a second rod 59 carrying the valve disc 57 may be arranged to abut against the main line valve disc 56 and to be resiliently pressed against the disc 56 by means of a biasing spring 61. Preferably, an adjustable needle valve 62 is also provided in the graduated pilot line.

The branch gas line 31 is branched against a T 63 having one outlet to the graduated pilot gas supply line 55 and a second outlet to a fixed flow branch line 64. The fixed flow branch line 64 passes through the head 47 of the safety unit 26 for support but is not connected thereto and terminates in the ignition pilot burner 23 as shown in Fig. 3.

The inlet to the passageway 54 is from the graduated pilot supply line 55, and the passageway continues past the valve seat 65 cooperating with the valve disc 57, through a cross passageway 66 beyond the needle valve 62 into an upwardly extending portion 67 (shown in Fig. 4*a*) and continues upward in front of the main line passageway 53 as seen in Fig. 4, but is not connected thereto, being connected instead to a cavity in the interior of the head 47 so as to supply gas to the ports 48, 49 and 51 and to an outlet gas supply tube 68 shown in Fig. 2. Gas flows to the graduating pilot 24 through the tube 68.

The valves, including the valve discs 56 and 57 are so constructed and the arrangement of the thermostatic strip 52 is such that the valve disc 56 normally closes the passageway 53 to its outlet 53A when the strip 52 is cool, that is when the jets are not burning at the ports 48, 49 and 51, and the valve including the disc 57 is normally open when the strip 52 is cool. The

area around the disc 56 is such that as soon as the main line valve is open a full supply of gas is admitted through the passageway 53 whereas the construction of the passageway 54 around the disc 57 is such that motion of the rods 58 and 59 as the strip 52 varies in temperature has a graduating effect on the gas admitted through the passageway 54 to the needle valve 62.

The inlet to the mainline passageway 53 is from the main gas line 29 and the outlet is to a continuation 69 forming a part of the main gas line which is connected to a mixer 71, which, in turn, is connected through a gas and air mixing tube 72 to the burner 15.

For certain gases it is preferable to supply primary air to the gas delivered to the initial flash pilot 24, so as to provide a blue-flame pilot having the proper mixture for flashing and not dependent upon secondary air aspirated around the port. For supplying such primary air, an opening 70 (Fig. 2) is provided in the body of the valve unit 26 and communicates with the passageway 67 (Fig. 4).

A domestic range has been described by way of illustration, but it will be understood that our invention is not limited thereto. The oven burner 15 is representative of any burner which is to be ignited remotely from a primary pilot, such as the constant burning pilot 13, or is on a different level or is inaccessible or enclosed or for some other reason not to be ignited directly like the range top burners 11. In the description and claims a burner which is to be ignited is occasionally referred to as a "main burner" to distinguish it from the igniting burners such as the pilot burner 24, for example. However, our invention is not limited to cases where the ignited burner is actually the largest burner in the apparatus or the final burner in a chain of successive ignitions.

Before the oven gas cock 21 is turned on manually, obviously no gas is admitted to the burner 15, and likewise no gas is admitted to any of the supplemental pilots such as the pilots 23 and 24, and the ports 38, 39 and 51 on the head 47 of the safety unit 26, serving as thermal pilots. However, the top pilot 13 is continuously burning and serves as a constant pilot from which the top burners 11 may be flashed directly or the oven burner 15 may be flashed in directly. When the manual control cock 21 is opened, gas is admitted to the oven temperature regulating valve 22. Gas is immediately admitted also to the branch line 31 regardless of oven temperature, and the gas is admitted to the main line 29 in proportion to the extent to which the oven temperature falls below the temperature for which the regulating valve 22 has been set. Gas continues to flow into the line 31 as long as the valve 22 is open. When the oven is cold, gas will of course be admitted through the line 29 to the passageway 53 of the safety unit 26 as far as the valve disc 56. The disc 56 is held in the upward position against its seat by the thermostatic strip 52, which is still cold, no thermal pilot jets in the head 47 having as yet been ignited. Gas from the line 31 is also admitted to the fixed flow branch line 64 and the pilot graduating supply line 55. Gas passing through the fixed supply line 64 admits gas to the ignition burner 23. The line 64 is continuous from the T 63 to the burner 23, passing through the block 47, but not connecting with any chambers therein. Since the strip 52 is still cold, the graduating valve including the disc 57 is still fully open admitting a rela-

tively large supply of gas from the line 55 through the passageways 54, 66 and 67 to the chamber 60 in the thermal pilot head 47. Thence gas passes through the graduated pilot line 68 to the initial flash pilot 24. Gas is injected by the port 38 of the pilot 24 into the flash tube 25 and the gas rises through the upward sloping arm 41 of the flash tube 25 to the constant pilot housing 35 where it is ignited by the jet 36, causing a flash back through the tube 25 igniting a jet at the port 38 of the flash pilot 24. The jets at the ports 43 and 44 of the ignition pilot 23 are ignited from the flash pilot 24 so that the oven burner 15 could be ignited if gas were admitted thereto.

A graduated gas supply through the passageways 54 and 67 also fills the interior chamber 60 of the head 47 causing gas to issue from the thermal pilot ports 48, 49 and 51. The gas issuing from the side port 48 is injected into the horizontal flash tube 28 and ignited by the side jet 44 of the ignition pilot 23. This causes ignition of the remaining jets in the thermal pilot head 47. The thermostatic strip 52 is then caused to rise in temperature and to open the disc 56 in the main line passageway admitting gas to the burner 15 and permitting it to be ignited from the ignition pilot 23. The operation is indicated schematically in Fig. 8, where the full-line arrows indicate the passage of flames successively from the top pilot burner 13 to the pilot burners 24, 23, 48 and 49. Whereupon heating the strip 52 causes the main line safety valve disc 56 to fall admitting gas to the main burner 15 which ignites from the ignition pilot burner 23.

The heating of the strip 52 also pushes the disc 56 downward upon the rod 59 partially closing the valve including the disc 57 so as to reduce the supply of gas to the head 47 and diminishing the size of the jets issuing from ports 48 and 49 of the thermal pilot until the strip 52 has cooled sufficiently so that an equilibrium exists between the size of the jets and the opening provided by the position of the graduating valve disc 57.

As previously explained, however, the construction of the safety unit 26 is such that the disc 56 is still far enough away from its seat to admit the full gas supply to the burner 15. The supply of gas to the initial flash pilot 24 is also graduated by the graduating valve 57 and, accordingly, the length of flame issuing from the port 38 is shortened. The arrangement is such that initially a relatively long flame is produced at the port 38 when the thermostatic strip 52 is cool so that there is assurance of prompt flashing of the initial flash pilot 24 from the constant burning top pilot 13. In order to avoid the continuance of such a long flame which would tend to pass products of combustion upward through the flash tube 25, the flash pilot 24 is supplied by the graduated line as just explained. Upon the heating of the strip 52 to its equilibrium value causing graduation of the pilot gas supply, the flame issuing from the port 38 is shortened to such an extent that it curls upward and does not extend into the open end 37 of the flash tube 25, and consequently does not introduce any hot air or combustion products into the flash tube 25.

When the oven space 14 reaches the desired temperature for which the regulating valve 22 has been set, although gas continues to flow through the line 31, gas supply is cut off to the main line 29 and the flame is extinguished around the burner 15. The valve 22 is controlled by the thermostat bulb 50 extending into the oven space 14 in a conventional manner. When the oven temperature falls again, since the ignition pilot 23 is normally still burning, the oven burner 15 is re-ignited by the ignition pilot 23. Gas flows to the pilot 23, through the lines 31 and 64 as long as the valve 22 is open. However, if the gas supply should have been turned off by the hand cock 21, or if the ignition pilot 23 should have been extinguished in some other manner there would be a danger of the full gas supply issuing from the burner 15 without being ignited except for the presence of the safety features provided. In the event of cutting off of gas through the supply line 31, gas cannot issue from the burner 15. Cutting off the supply through the line 31 would, of course, cut off gas also to the thermal pilots at the head 47 of the safety unit 26, causing the strip 52 to cool off, and to close the main-line passageway 53.

In case the line 31 should remain open but the pilots 23 and 24 should be blown out, they will be re-ignited either from the constant burning pilot 36 or the jet issuing from the side port 48 in the head 47 of the safety unit 26. If for any reason the constant pilot 36 should have been blown out or extinguished, the ignition pilot 23 may be ignited from the flames in the ports of the head 47 of the safety unit 26 so that the safety unit 26 cannot have its bi-metallic control strip 52 heated without causing ignition of the ignition pilot 23 and the burner 15. This is represented by the dotted arrows in the flash tube 28 in Fig. 8. Thus the flash tube 28 provides for flashing in either direction depending upon which end of the flash tube has a gas jet burning. Consequently, there is no danger of gas supply being admitted to burner 15 without ignition of the gas no matter which one of the various pilot lights may inadvertently become extinguished or may not be lighted.

If the hot air in the oven compartment 14 should have any tendency to pass upward through the flash tube 25 and should cause any delay in the flashing of the flame downward from the constant pilot 13 to the initial flash pilot 24 when the thermostatic valve 22 is re-opened after having been closed, there is no danger of gas supply being admitted to the burner 15, because in this case the thermal pilot jets issuing from head 47 of the safety unit 26 do not become ignited and heat the bi-metallic strip 52. Nevertheless, if desired, a relay pilot 73 may be provided as illustrated in Figs. 5 and 7 in order to increase the speed of operation of the flash tube and also in order to eliminate any possible tendency for hot air in the oven compartment 14 to vent into the pilot housing 35 of the constant burning top pilot 13.

In the arrangement of Figs. 5, 6 and 7 the single piece oven flash tube 25 represented in Figs. 1 and 2 is replaced by an oven flash-tube system comprising a vertical arm flush-tube 74 having an open lower end to which a flared downwardly extending hood 75 is connected. The upper end of the vertical arm flash tube 74 is bent over horizontally as in the arrangement of Fig. 2 for connection to the top pilot housing 35. The substantially horizontal slightly sloping lateral arm 41 of the single piece oven flash tube 25 shown in Figs. 1 and 2 is replaced in the embodiments of Figs. 5 and 7 by a separate transverse or lateral flash tube 76 extending from the flash pilot 24 to the hood 75, which has a side opening therein 77, to receive the outer end of the flash tube 76 as illustrated in Fig. 7. The relay pilot 73 is mounted with an upwardly open port 78 slightly

above the level of the lower edge 79 of the flared hood or open mouth 75 at the bottom of the vertical arm flash tube 74. Thus an open relief space 81 is provided around the relay pilot 73. The vertical arm flash tube 74 is so positioned that it and the hood 74 are located on the outer side of a shield plate 82, which is in turn at the outer side of the safety control valve unit 26. The relay pilot is connected to an aperture in the head 47 of the safety unit 26.

Assuming that the oven burner 15 is originally turned off, and that the thermostatic strip 52 is cold, as soon as the thermostatic valve 22 admits gas to the supply lines 29 and 31, gas is admitted to the graduated pilot line 55 and the graduating valve of the unit 26 to the relay pilot 73 as well as to the initial flash pilot 24 and the ports in the head 47 of the safety control unit 26. Gas issuing from the port 78 is injected into the hood 75 and the vertical arm flash tube 74 to the constant burning top pilot housing 35 and ignited from the jet 36. Fresh air for producing a combustible mixture is introduced through the open space 81 into the tube 74. Consequently, the flashing of the flame from the jet 36 to the port 78 takes place uniformly unaffected by the temperature of the air within the oven compartment 14. The compression wave of the flash-back is relieved. After the relay pilot 73 has been ignited the flame is flashed back from it through the flash tube 76 to the initial flash pilot 24 which ignites the ignition pilot 23. Remaining operations take place as in the case of the apparatus of Figs. 1 to 4. Since the mouth 81 of the hood 75 at the lower end of the vertical arm flash tube 74 is open, a relief space is provided for overcoming a compression wave and no delay is caused in the flash back from the jet 36 to the port 78. Thus the heat of any air within the compartment 14 does not cause a counter current blocking the downward motion of a flash from the constant pilot 15 to the relay pilot 73.

We have herein shown and particularly described certain embodiments of our invention and certain methods of operation embraced therein for the purpose of explaining its principle of operation and showing its application but it will be obvious to those skilled in the art that many modifications and variations are possible and we aim, therefore, to cover all such modifications and variations as fall within the scope of our invention which is defined in the appended claims.

What is claimed is:

1. In combination a top pilot burner, an oven burner to be ignited, an oven burner ignition pilot burner adjacent the oven burner, a graduated initial flash pilot burner adjacent the ignition pilot burner, flash tubing from said initial flash pilot burner to said top pilot burner for igniting the initial flash pilot burner from the top pilot burner, a source of gas with a main line for supplying the oven burner, an outlet paralleling the main line for supplying the ignition pilot burner when the main line is supplying gas, a pilot line for supplying the graduated pilot burner, and a pilot thermal-responsive safety control means comprising a normally closed valve interposed in said oven line for cutting off gas except when the ignition pilot burner is burning and a normally open graduating valve interposed in said pilot line for cutting down the initial flash pilot flame when the ignition pilot burner is ignited.

2. In combination, a constant pilot burner, a main burner to be ignited, an ignition pilot burner adjacent the main burner, a graduated initial flash pilot burner adjacent the ignition pilot burner, flash tubing from said initial flash pilot burner to said constant pilot burner for igniting the initial flash pilot burner from the constant pilot burner, a thermal pilot burner apart from said main burner, a temperature responsive movable member in thermal relation to said thermal pilot burner, a main gas supply line, an outlet paralleling said line for supplying gas to the ignition pilot when the main line is supplying gas, a pilot gas line for supplying the initial flash pilot burner and the thermal pilot burner, a normally closed valve interposed in said main line and a normally open graduating valve interposed in said pilot line, said valves being mechanically connected in controlled relation to said temperature responsive member for respectively opening the normally colsed valve and reducing the opening of the graduating valve when the temperature responsive member is heated by said thermal pilot burner.

3. In combination a constant pilot burner, a main burner to be ignited, an ignition pilot burner adjacent the main burner, a graduated initial flash pilot burner adjacent the ignition pilot burner, flash tubing from said initial flash pilot burner to said constant pilot burner for igniting the initial flash pilot burner from the constant pilot burner, a main gas supply line for the main burner, a line for supplying the ignition pilot burner, a pilot line for supplying the initial flash pilot, and a pilot-responsive safety control comprising a normally closed valve interposed in said main gas line for cutting off gas except when the ignition pilot burner is burning and a normally open graduating valve interposed in said pilot line for cutting down the initial flash pilot flame when the ignition pilot burner is ignited.

4. In combination a constant pilot burner, a main burner to be ignited, an ignition pilot burner adjacent the main burner, a graduated initial flash pilot burner adjacent the ignition pilot burner, a relay pilot at substantially the level of the initial flash pilot burner, a substantially horizontal flash tube from the initial flash pilot burner to said relay pilot burner and a vertically rising flash tube from the relay pilot burner to the constant pilot burner for igniting the initial flash pilot burner from the constant pilot burner through the relay pilot burner, a main gas supply line for the main burner, a line for supplying the ignition pilot burner, a pilot burner line for supplying the initial flash pilot burner and the relay pilot burner, and a pilot burner responsive safety control comprising a normally closed valve interposed in said main gas line for cutting off gas except when the ignition pilot is burning, a normally open graduating valve interposed in said pilot line for cutting down the initial flash flame and the relay pilot burner flame when the ignition pilot burner is burning, and temperature responsive movable means connected to said valves for actuating them, said means being exposed to flame heat of gas supplied through said graduating valve, whereby burning of such gas results in heat which moves the normally closed valve open and moves the graduating valve away from fully open position, such gas supplied through the pilot line and gas supplied to the ignition pilot burner through its

line normally burning simultaneously, one being ignited from the other.

5. In combination, a constant pilot burner, a main burner to be ignited, an ignition pilot burner adjacent to the main burner, an initial flash pilot burner adjacent to the ignition pilot burner, a relay pilot burner at substantially the level of the initial flash pilot burner, a substantially horizontal flash tube from the initial flash pilot burner to said relay pilot burner and a vertically rising flash tube from the relay pilot burner to the constant pilot burner through the relay pilot burner, a main gas supply line for the main burner, a line for supplying the ignition pilot burner, a pilot line for supplying the initial flash pilot and relay pilot burner, and a pilot responsive safety control comprising a normally closed valve interposed in said gas line for cutting off gas except when the ignition pilot is burning and a normally open graduating valve interposed in said gas line for cutting down the initial flash pilot frame and relay pilot flame when the ignition pilot burner is ignited.

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