



(51) International Patent Classification:

A62C 2/04 (2006.01) A62C 35/13 (2006.01)
A62C 3/00 (2006.01) G08B 17/06 (2006.01)
A62C 31/02 (2006.01) G08B 25/00 (2006.01)

(21) International Application Number:

PCT/IL2015/050800

(22) International Filing Date:

3 August 2015 (03.08.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

234059 11 August 2014 (11.08.2014) IL

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: FIRE SUPPRESSION DEVICE

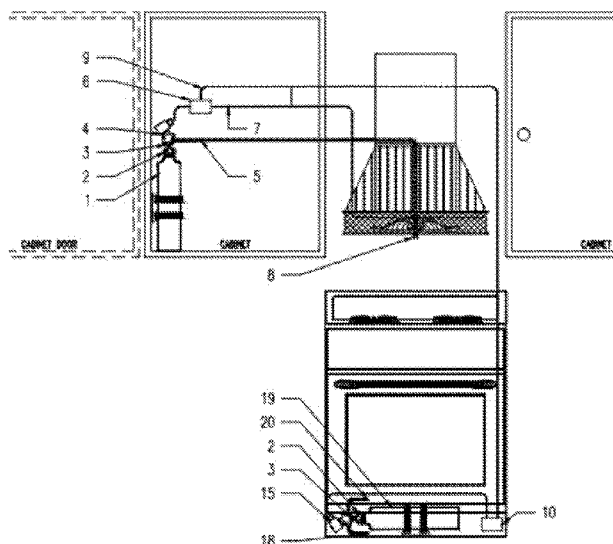


Fig. 1

(57) Abstract: The system of the present inven-
tion is comprised of the following: a fire extin-
guisher; solenoid adapted to release said extin-
guisher; a flexible conduit adapted to direct the
contents of the extinguisher to the stove; a linear
heat detector for sensing fire; a disconnecting box
adapted to disconnect the cooking gas or electri-
city from stove at the event of fire; a second CO2
gas or equivalent gas container that is connected
to the disconnecting box; another solenoid adap-
ted to release said gas container; more conduits
connected to each of the burners in the stove. In
this configuration, fire suppression, and gas cutoff
are effected simultaneously. Additionally to the
above mentioned effects, the system further simul-
taneously injects CO2 or similar extinguishing gas
instead of natural gas straight to the burner itself
suffocating the fire at the source.

WO 2016/024267 A1

FIRE SUPPRESSION DEVICE

5 FIELD OF THE INVENTION

The present invention relates to the field of fire suppression devices, more particularly, to an affordable fire suppression device for home use.

BACKGROUND OF THE INVENTION

10 Household cooking equipment (stoves, ranges, grills, etc) are a leading cause of domestic fires and related injuries. After heating equipment, stoves are the second most common cause of home fires and consequent injuries and death, according to the National Fire Protection Association (NFPA).

The most highly-recommended and commonly-used solution for residential use is the
15 smoke alarm, which as will be appreciated, does not suppress the fire but only indicates smoke or outbreak of fire by audible means. This brings notice to but does not solve the problem, especially when the house owner is not present or if the alarm is tripped only when the fire has already spread and cannot be contained. These are just several reasons why the fire alarm is an insufficient and partial solution at best.

20 Sprinkler system, if installed, will suppress a fire but will not shut off the source, which may be a gas line, electric line, or the like.

Existing fire suppression systems have a wide range of implementations, which in many cases do not eliminate the origin of the fire. If the suppression system is not of sufficient power, or is limited in time (e.g. a fire extinguisher with limited volume)
25 the fire will often rapidly grow out of control. For example, fires fed by uninterrupted gas or electric supplies may continue even after activation of a suppression system.

Some small and medium size businesses can afford a "smart" industrial kitchen suppression fire system, which nowadays are very costly. In any case businesses are forced by law to implement such systems to prevent fatalities where large gathering of people generally occurs.

Current systems require inhabitants to play an active role in fighting a fire. In the case of stove fires fed by electric or gas sources, the inhabitants must risk their own lives, trying manually to shut off gas supplies or electricity switches in cases of fire. Professional guidance suggests leaving the house, letting the fire burn and not risking lives. Both routes are problematic, the first risking injury and the second property damage.

There thus remains a long-felt need for means to suppress kitchen/oven fires, requiring neither personal risk nor property damage.

The prior art below are components of costly industrial and commercial fire extinguishing systems. The components alone do not effectively handle residential fires.

US6527058 describes a pressurized container as a housing of the fire suppressing wet chemical for kitchen applications. Commonly referred as a "Fire Extinguisher", this device aids in small fires and is not intended for use on larger fires, such as one which has reached the ceiling or that has spread through the interior. Further, the device is hand held which puts the user at direct risk of injury. It also requires a degree of skill and familiarity with the procedure of operating this hand held device. Kitchen fires can become out-of-control in seconds. In many cases the fire extinguisher is ineffective, as gas or electricity power keep adding fuel or electrical energy to the fire, feeding it despite suppression efforts downstream. The

extinguisher has no detection system what so ever and requires external activation. Finally if the extinguisher is not directed to the source of the flame it will be entirely ineffective.

55 The following three patents all have specific elements which solve very specific problems but do not offer a unified solution for detection, alerting, disconnection of fuel source, nor suppression of the fire.

US5297636 describes a flexible hose connected to a nozzle for transferring contents of a fire extinguisher for residential cook stoves and ranges. A tube specially tailored
60 for the carrying anti-fire materials is used, but does not inform of a fire eruption. By itself it also cannot stop the gas flow.

US3713493 describes a safety valve for discharging a fluid medium from a fire extinguisher. Malfunction of the valve is a common occurrence and can cause high probability of fatalities.

65 Both of the last patents are devices handling pressure levels in an anti-fire material tank and not a comprehensive solution for kitchen fires. The systems do not alert occupants of a fire. The devices do not make sounds or give any active indication that a fire occurred.

US4175677 describes a tubing detector positioned in the fire hazard area. This is a
70 heat affected area, while the device is not heat proof. Further, **US5186260** describes a sensor wire covered with a plastic insulation employed inside of a range hood, especially wires manufactured by "Protectowire", Inc. This solution is a heavy duty wire which can be installed in sophisticated fire extinguishing systems. It is one element of a whole system that currently is not offered for common households.
75 Such systems are only built for high risk commercial and industrial hazards and

therefore do not aid common households. Further, it is not aesthetic nor convenient to have multiple wires routed through every corner of the house for purposes of fire detection; a more pinpoint solution is required.

The following patents are particular devices as part of full composed systems built in
80 industrial or commercial usage; none are currently fit for homes.

US5127479 describes a micro switch operating either a gas valve or electrical switch via a 12-volt solenoid to shut off the supply of electricity or gas when the micro switch detects a discharge by the fire extinguisher.

US5127479 describes a horn activated upon operation of a micro switch by closing
85 the normally open contact in 12-volt relay.

US5127479 describes a shut-off mechanism which shuts off electrical power or gas to the stove, Further **US4834188** describes a micro switch closing normally open contact which interrupts gas or electricity.

There remains a long-felt need for an affordable residential range /stove fire
90 extinguishing system.

SUMMARY OF THE INVENTION

Main configurations

The present invention presents an independent fire suppression system for household
95 stoves and ranges.

The system is comprised of the following: a fire extinguisher; solenoid adapted to release said extinguisher; a flexible conduit adapted to direct the contents of the

extinguisher to the stove; a linear heat detector for sensing fire; a disconnecting box adapted to disconnect the cooking gas or electricity from stove at the event of fire.

- 100 The system is intended for gas stoves and is further comprised of a second CO₂ gas or equivalent gas container that is connected to the disconnecting box; another solenoid adapted to release said gas container; more conduits connected to each of the burners in the stove.

In this configuration, fire suppression, and gas cutoff are effected simultaneously.

- 105 Additionally to the above mentioned effects, the system further simultaneously injects CO₂ or similar extinguishing gas instead of natural gas straight to the burner itself suffocating the fire at the source.

In another configuration at least one additional conduit is leading to at least 1 nozzle adjacent to the heat source of the stove.

- 110 In this second configuration, additionally to the above mentioned effects of the invention, the system further simultaneously injects CO₂ or similar extinguishing gas instead of natural gas near the burner or electric heat source itself suffocating the fire at the source.

- It is to be mentioned, that the CO₂ container is also characterized at storing highly
115 compressed CO₂ or similar gas, which has inherently low temperature close to 0 degrees Celsius, which in an event of a fire, brings the environment temperature down close to zero in addition to the above mentioned effects.

- The device has the potential to save life, and is more effective than any other existing product in the market for the specific target audience, such as
120 household/apartment/condo residents. The system may be built with approved and

rated components, which are not inordinately expensive and are intelligently engineered.

Linear heat detector

The system detects fire by means of a linear heat detector. On sensing a fire, the fuel
125 (or electrical supply) is shut off, a warning siren is activated, and simultaneously a
suppression system is activated, these operations being entirely automatic and not
requiring action on the part of the occupant (if indeed there are any).

System operation

Fire is sensed by the linear heat detector, and this signal is used to trigger the
130 solenoid to activate the suppression system (which comprises an extinguisher).
Simultaneously the device cuts off the electricity/gas to the range. A sounder alerts
the residents and nearby neighbors. The sum of the components, composed in the
specific manner of the invention creates a new function for an entire population in
need.

135 The foregoing embodiments of the invention have been described and illustrated in
conjunction with systems and methods thereof, which are meant to be merely
illustrative, and not limiting. Furthermore just as every particular reference may
embody particular methods/systems, yet not require such, ultimately such teaching is
meant for all expressions notwithstanding the use of particular embodiments.

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BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments and features of the present invention are described herein in
conjunction with the following drawings:

Fig. 1 presents a system diagram consistent with certain embodiments of the
145 invention;

Fig. 2 presents a system diagram consistent with certain embodiments of the
invention;

Fig. 3 presents a circuit diagram consistent with certain embodiments of the
invention; and,

150 Fig. 4 presents a circuit diagram consistent with certain embodiments of the
invention; and,

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be understood from the following detailed description of
155 preferred embodiments, which are meant to be descriptive and not limiting. For the
sake of brevity, some well-known features, methods, systems, procedures,
components, circuits, and so on, are not described in detail.

Nearly half all of US home fires originate in the kitchen and involve cooking
equipment. 38% of home fire injuries and 15% of home fire deaths result from such
160 fires. [NFPA 2006-2010 "Home Fires involving Cooking Equipment", November
2012].

Amongst such kitchen fires, 58% start on a range or cook top. Given the total number
of reported fires in the US involving cooking equipment in the 5 year period 2006-
2010 of 157,300, and the average cost to repair/restore a house fire of \$49,000, one
165 arrives at over \$1B USD lost to range fires every year in the US alone.

The present invention provides a method for sensing and suppressing such fires.

With reference to Fig. 1, fire is sensed by a linear heat detector 7. This signal is used to activate a relay 17 housed in the disconnecting box 10. This relay 17 cuts off the electricity (or flow of gas) to the range and makes the sounder 11 go off. In parallel, this signal turns on the solenoid 4 thus activating the suppression.

All components of the system are already or are in the process of approving by UL, including the Wet Chemical Agent Compressed Cylinder 1, gauge 2, safety valve 3, solenoid valve 4 with flexible conduit 5 connected to a nozzle 8, a linear heat detector 7, wiring 9, a junction box 6, disconnecting box 10 with a sounder 11 and low voltage supply unit 12, equipped with a range receptacle 13 and wired range plug 14.

The invention further comprise a compressed carbon dioxide or similar gas container 19 connected to said disconnecting box, and further connected to a multi-way solenoid valve 15 adapted to inject carbon dioxide through a plurality of conduits 18, 20. Wherein said conduits 18, 20 are each conveying said gas through a burner of the stove when a fire is detected. This allows for diluting oxygen in the vicinity of the fire source and inside the burner/coil units and thereby extinguishing it.

The multi-way solenoid valve 15 is adapted to allow the flow of said gas into a plurality of conduits 18, 20 as required by the quantity of burners in the stove. This property is in contrast to the regular solenoid 4, which is adapted to allow the discharge of extinguisher 1 only through one conduit 5.

Referring now to Fig 2, the invention may further comprise a compressed carbon dioxide or an equivalent gas container 19 connected to the disconnecting box 10 and adapted to inject said gas through a nozzle 8 adjacent to the heat source for the purposes of diluting oxygen at the fire source and thereby extinguishing it.

The disconnecting box

With reference to Figs 3-4. For LNG oven/ranges the range disconnection box 10 controls the gas supply 18 via a Residential Gas Control Valve (UL approved) 15 and is equipped with a standard power plug 16. For the case of electric ranges, the
195 range disconnection box simply comprises an outlet 13 of which the range must be connected to 18. The components of the disconnecting box 10 of Fig. 1 are depicted in Fig. 4 and Fig 5. Here one sees the plug 14/16 (and outlet 13 in the electrical box), as well as transformer 12 and relay 17. The device is plugged in using the standard/range wall plug 14/16. This powers the 110VAC/220VAC to 24VAC
200 transformer 12, and this signal is run along the linear heat detector 7. When a fire event is detected, the heat detector 7 activates the fire extinguisher 1 (via its solenoid 4), shutting off the gas or electric supply to the range via the relay 17, and activates the alarm sounder 11.

This system is subject to approval by the UL in accordance to UL Subject 300A
205 which comprises requirements of fire suppression (a given amount of oil in a given amount of time, at a defined distance and over a defined area). A further alarm and panel notification (not shown) are not mandatory but may also be included in the system for purposes of notifying users of status (e.g. 'normal' vs. 'fire').

It is within provision of the invention to disconnect range electrical power (or gas
210 supply in the case of a gas range) in the event of fire detection. In this way, an energy source that would otherwise feed the fire, is eliminated.

Restoring operation after fire

To restore power to the oven, the linear heat detector must be replaced, and the cylinder is refilled and compressed by a licensed service. The linear heat detector

215 must be replaced since after a fire it has shorted closed and will thereby signal a fire forever after; pulling apart the linear detector will generally be impossible since the conductive elements will have fused together, and even if this has not occurred, an element that has already shorted closed cannot be used again according to fire code restrictions; it must be replaced with a new, unshorted element.

220 Meanwhile, the customer may bypass the system and connect the power plug directly to the wall receptacle.

Further embodiments

It is known in the art to use compressed wet chemical agent cylinders, and to employ a nozzle and flex conduit connected thereto. The use of sounders are found in
225 existing patents, as well as the use of a range disconnection box.

However the use of gauge and safety valve (which secures discharge of agent before the system is installed and inspected) is novel, as is the use of a linear heat detector or cable type flame detector. Furthermore the use of a solenoid valve actuating unit is novel.

230 It is within provision of the invention that no manual operation is required in the case of fire; the fire is extinguished and range disconnected automatically, reducing the risk of injury entailed when trying to manually shut off gas or electric supply to a range engulfed in a fiery inferno.

It is within provision of the invention to further utilize a control unit such as a
235 microprocessor-based control unit adapted to immediately notify remote entities of the fire event. This may be accomplished by means of an audible alarm, visible indicator, cellular and/or land line communications (for instance playing a recorded announcement or sending an SMS), and internet connection (for instance sending an

email notification). The control unit may be connected electrically to the fire
240 detection means as will be clear to one skilled in the art. These notifications may be
sent for instance to the house or apartment owner and/or resident, as well as relevant
authorities such as the fire department.

The internet or cellular connection referred to above may be used to transmit
information concerning a fire to the cloud (e.g. a local or remote net-connected
245 server) thereby allowing devices including smart phones, tablets, and other network
connected devices to observe said information, either actively or passively.
Furthermore this server may be in electronic communication with additional system
elements such as breakers for the household mains electricity, comprehensive
detection system which serves the entire building/complex, a deluge sprinkler
250 systems, specific electrical switches of the household, flow controllers for gas
supply, and the like.

The foregoing description and illustrations of the embodiments of the invention has
been presented for the purposes of illustration. It is not intended to be exhaustive or
to limit the invention to the above description in any form.

255 Any term that has been defined above and used in the claims, should be interpreted
according to this definition.

CLAIMS

1. An independent fire suppression system for household gas stoves and ranges comprising:

- a. a compressed wet chemical extinguisher and gauge in fluid communication therewith;
- b. a solenoid adapted to allow the release of contents of said extinguisher;
- c. a flexible, heat proof conduit adapted to direct the contents of said extinguisher to said stove;
- d. a supply line adapted to provide electrical power or fuel to said range;
- e. a linear heat detector adapted to sense fire from said range;
- f. a disconnecting box adapted to disconnect said supply line when said linear heat detector detects extreme heat;
- g. a compressed carbon dioxide or equivalent gas container connected to said disconnecting box adapted to inject said gas- through a burner of said stove for the purposes of diluting oxygen in the vicinity of fire source and thereby extinguishing it.

wherein fire suppression, and gas cutoff, are all effected simultaneously by use of a linear heat sensor.

2. The system as described in claim 1, wherein said compressed carbon dioxide or equivalent gas container connected to said disconnecting box adapted to inject said gas through a nozzle adjacent to the heat source for the purposes of diluting oxygen in the vicinity of the fire source and thereby extinguishing it.

3. The system as described in claim 1, further comprising a control unit enabling immediate notification of remote entities by means selected from: land line, cellular connection, internet connection.

4. The device of claim 3 wherein said internet connection is used to transmit information concerning a fire to the cloud thereby allowing devices including smart phones, tablets, and other network connected devices to observe said information and control actuators selected from the group consisting of: household main electricity switch, sprinkler systems, specific electrical switches of the household, flow controllers for gas supply.

5. The system as described in claim 1, further comprising an alarm in connection to said disconnecting box, wherein, upon a fire said disconnecting box activates said alarm.

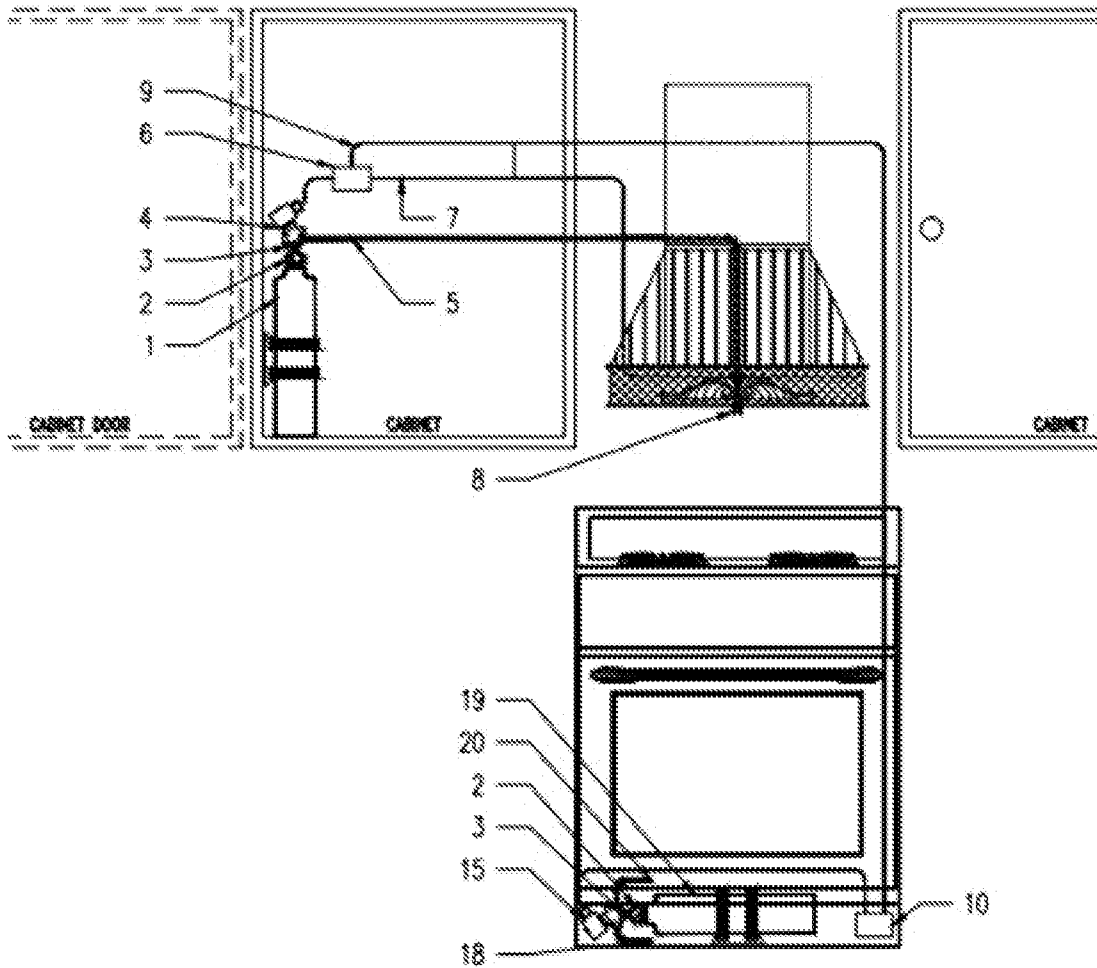


Fig. 1

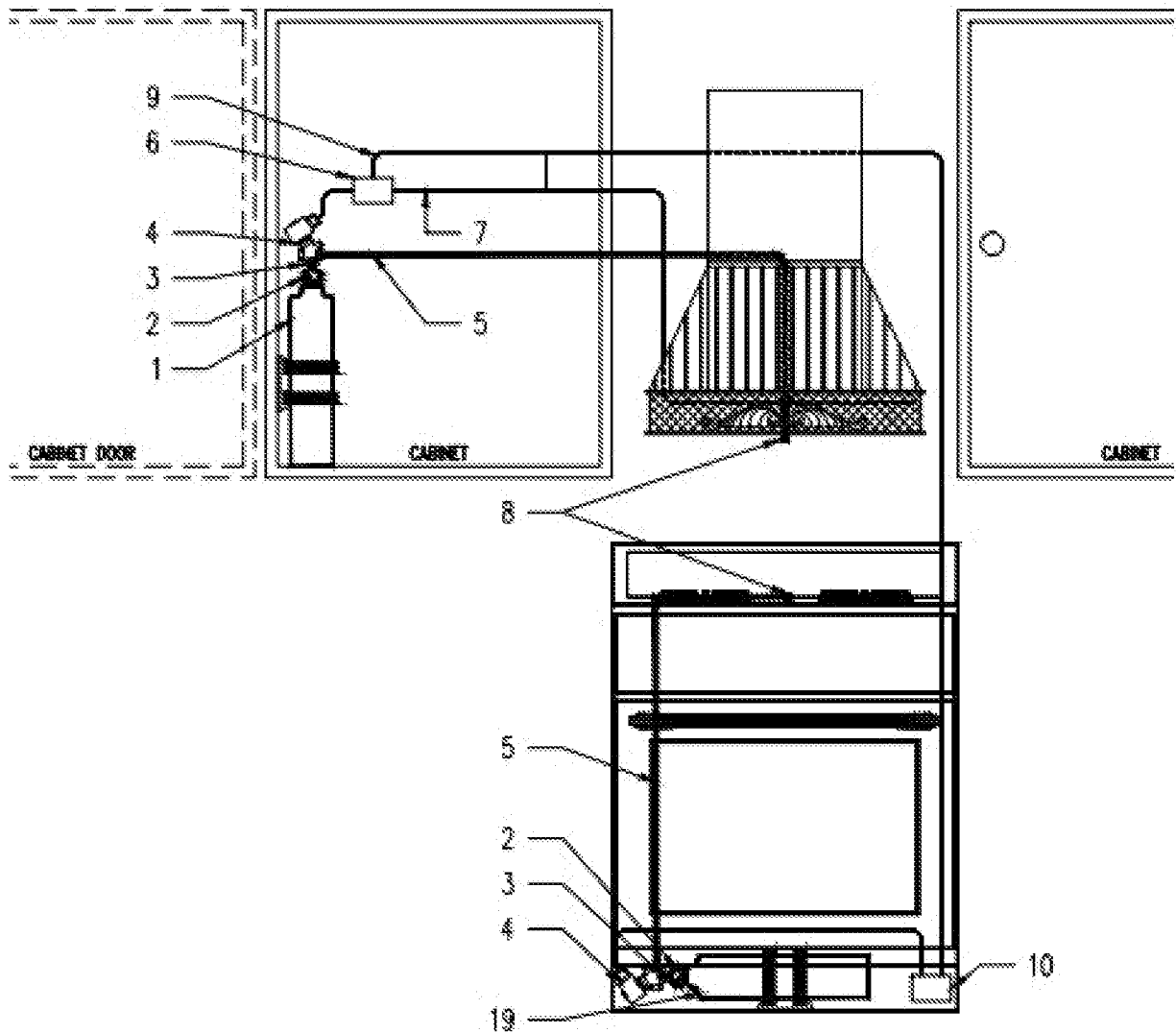


Fig. 2

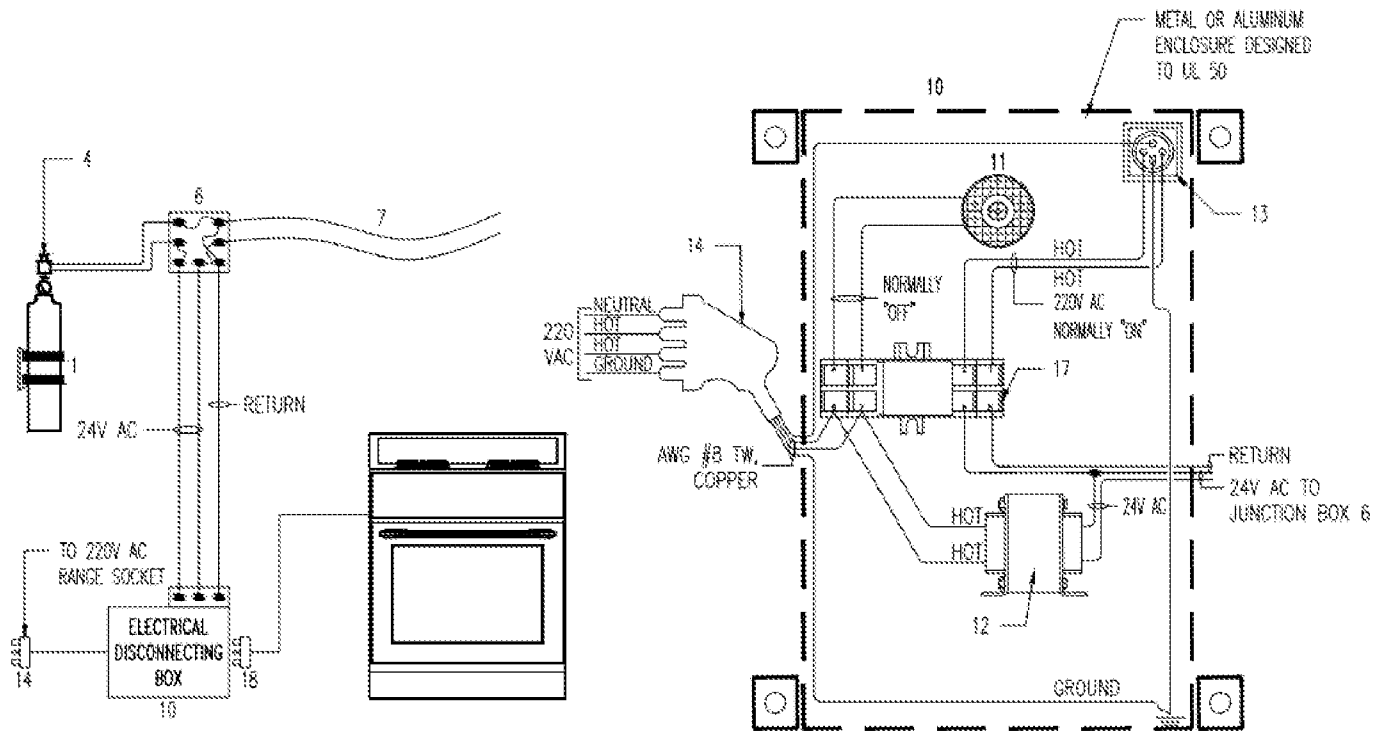


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2015/050800

A. CLASSIFICATION OF SUBJECT MATTER

IPC (2015.01) A62C 2/04, A62C 3/00, A62C 31/02, A62C 35/13, G08B 17/06, G08B 25/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC (2015.01) A62C 2/04, A62C 3/00, A62C 31/02, A62C 35/13, A62C, G08B 17/06, G08B 25/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Databases consulted: PATENTSCOPE, Esp@cenet, Google Patents, PatBase

Search terms used: (Range OR stove) AND fire and (detect* OR sens*) AND (extinguish OR suppres*) AND gas AND solenoid AND linear heat AND disconnect AND (CO2 OR carbon dioxide)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5186260 A SCOFIELD WILLIAM 16 Feb 1993 (1993/02/16) All document	1-5
A	US 3584688 A DUNCAN DONALD LEE et. al 15 Jun 1971 (1971/06/15) All document	1-5
A	US 4834188 A SILVERMAN ROBERT R 30 May 1989 (1989/05/30) All document	1-5
A	US 3653443 A WALTER E. DOCKERY 04 Apr 1972 (1972/04/04) All document	1-5

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

12 Nov 2015

Date of mailing of the international search report

17 Nov 2015

Name and mailing address of the ISA:

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No. PCT/IL2015/050800
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Patent document cited search report	Publication date	Patent family member(s)	Publication Date
US 5186260 A	16 Feb 1993	US 5186260 A	16 Feb 1993
		US 5207276 A	04 May 1993
		US 5355026 A	11 Oct 1994
US 3584688 A	15 Jun 1971	US 3584688 A	15 Jun 1971
US 4834188 A	30 May 1989	US 4834188 A	30 May 1989
		US 4834188 B1	22 Dec 1992
		US 4773485 A	27 Sep 1988
		US 4773485 B1	18 Jun 1991
US 3653443 A	04 Apr 1972	US 3653443 A	04 Apr 1972