(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 April 2014 (17.04.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/058716 A1

(51) International Patent Classification:
H01H 3/02 (2006.01) *F24C 3/12* (2006.01)

(21) International Application Number:
PCT/US2013/063343

(22) International Filing Date:
4 October 2013 (04.10.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/711,841 10 October 2012 (10.10.2012) US

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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, LT, 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, 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: VALVE SYSTEM FOR GAS COOKING RANGE WITH INTEGRATED IGNITION SWITCH

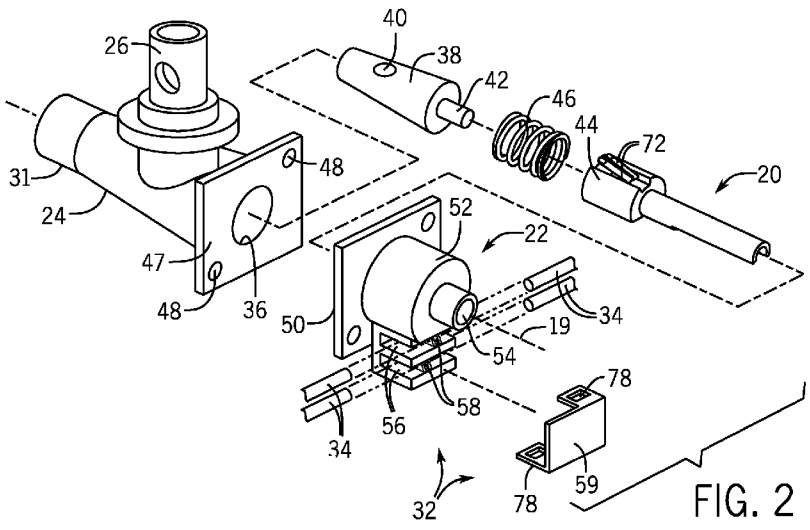


FIG. 2

(57) Abstract: An ignition switch for a gas range includes a valve stem receivable by a knitting cover of a console of the gas range. A valve body extends rearwardly from the knitting cover and is configured to be coupled with a gas manifold. A connector block is connected to the knitting cover and defines first and second channels. First and second insulation displacement connectors (IDCs) are received within the respective first and second channels and configured to securely receive and remove insulation from a corresponding first and second ignition wire to form a gas tight seal between a conductor of each of the ignition wires and the corresponding IDC. The IDCs comprise contacts configured to operable engage contact fingers of the valve stem to conduct electrical power from one power wire to an ignition wire.

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VALVE SYSTEM FOR GAS COOKING RANGE WITH INTEGRATED IGNITION SWITCH

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 61/711,841 filed October 10, 2012 hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to cooking ranges having gas burners and specifically to a gas valve for use with such cooking ranges.

BACKGROUND OF THE INVENTION

[0003] Gas ranges which cook using the combustion of natural gas or the like in gas burners are prized by chefs who value the fast response and high heat output of gas burners. Such gas ranges may use gas valves which meter gas to individual burners according to rotation of a valve stem communicating with an internal valve mechanism. Control of the gas valves by a consumer is provided by rotation of a control knob fitting over an end of the valve stem as it passes through a console on the front of the range. By controlling the volume flow of gas to the burner, the output of the burner may be adjusted.

[0004] Many modern gas ranges include electronic igniters that may be triggered by movement of the valve stem as detected by a sensor switch to automatically ignite the gas at the burner. Normally, the switches used to control the electric igniters are pre-assembled to a wiring harness and the harnesses and switches are then attached to individual gas valves, for example, by molded engagement features in the switch bodies. The valves and the attached switches and harnesses are then attached to a common supply manifold and assembled into the range. The use of a pre-manufactured harness simplifies manufacture of the range but is complicated by a wide variety of different harness styles needed for different range types.

SUMMARY OF THE INVENTION

[0005] The present invention provides an ignition switch that is fully integrated with the gas valve eliminating additional parts required when these elements are separately manufactured. Wiring of the integrated switches is made possible through insulation displacement connectors (IDC) that allow wires of the harness to be installed after the valves have been mounted to the range. This method of attaching the wires eliminates the step of pre-manufacturing a harness while insuring that the proper lengths of wire are used between each valve.

[0006] Specifically, the present invention provides an integrated gas valve ignitor switch having a gas valve providing a housing supporting a valve core therein, the valve core rotatable by a valve stem between a range of open positions, at which the valve core receives

a gas flow through an inlet port in the housing and conducts the gas flow through the valve core to an outlet port in the housing, and a close position where the valve core blocks gas flow between the inlet port and outlet port. An electrical switch is fixed with respect to the housing and communicates with the valve stem to provide an electrical switching of at least one open position for activation of the gas ignitor. At least two insulation displacement connectors are fixed with respect to the housing to provide an electrical connection between the switch and a first and second insulated conductor.

[0007] It is thus a feature of at least one embodiment of the invention to provide a system of interconnecting electrical switches integrated into gas valves at the time of manufacture without the need for pre-manufactured harnesses. The IDC elements allow interconnecting wiring to be installed on the gas valves after they are installed in fixed mechanical separation on the manifold for reduced wire slack and greater versatility when different numbers of valves are present.

[0008] The integrated gas valve ignitor switch may further include a cover fitting over the insulation displacement connectors when they receive the first and second insulated conductors.

[0009] It is thus a feature of at least one embodiment of the invention to provide good access to the IDC elements for assembly during manufacture and yet to provide covering of electrically conductive parts.

[0010] The insulation displacement conductors may provide a slot sized to displace insulation from the first or second insulated conductor to make electrical contact with a contained conductive core and the first and second insulation displacement connectors may fit within longitudinal channels with the slot oriented perpendicularly to the channel to receive the first and second insulated conductors extending along the channel.

[0011] It is thus a feature of at least one embodiment of the invention to provide guiding channels to help orient the conductors with respect to the insulation displacement connectors.

[0012] The channels may extend substantially perpendicularly to an extent of the valve stem.

[0013] It is thus a feature of at least one embodiment of the invention to provide channel orientation conducive to daisychain connection of multiple valves along the manifold during manufacture.

[0014] The covers fitting over the insulation displacement connectors and the channels when they receive the first and second insulated conductors may be held by a snap connection.

[0015] It is thus a feature of at least one embodiment of the invention to provide covers that may be installed with low clearance or without tools during manufacture.

[0016] The insulation displacement conductors may provide first contact elements for the electrical switch that engage and disengage with movable second contact elements rotating with the valve stem.

[0017] It is thus a feature of at least one embodiment of the invention to provide a reduced cost electrical switch employing the same metal stampings used in the IDC element.

[0018] The first contact elements may be tangential to a circle centered on a rotational axis of the valve stem and the second contact elements move along the circle to wipe across the first contact elements with rotation of the valve stem.

[0019] It is thus a feature of at least one embodiment of the invention to provide a high reliability, low resistance connection when using material of the IDC element by incorporating a wiping action in the switch.

[0020] The electrical switch may include an injection molded thermoplastic housing supporting electrical contacts and the insulation displacement connectors. The insulation displacement conductors may be in-molded to the thermoplastic housing.

[0021] It is thus a feature of at least one embodiment of the invention to provide an integrated switch and IDC element assembly for increased reliability and lower cost.

[0022] Other features and advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, claims and drawings in which like numerals are used to designate like features.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] Fig. 1 is a perspective view of a gas range having multiple controls showing an exploded view of one such control providing an integrated gas valve and ignition switch;

[0024] Figs 2 is an exploded diagram of the control showing a wiper contact mounted on a control operator providing the valve stem and the location of IDC elements attached to a knitting cover of the valve;

[0025] Fig. 3 is a side elevational view and top plan view of an IDC element that may be in-molded into the knitting cover of Fig. 2;

[0026] Fig. 4 is a cross-sectional view through the control of Fig. 1 as assembled taken along line 4-4; and

[0027] Fig. 5 is an exploded diagram of successive insulation steps of installing the integrated gas valve and ignition switch on a manifold.

[0028] Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use

of "including" and "comprising" and variations thereof are meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0029] Referring now to Fig. 1, a gas range 10 may include one or more burners 12 exposed at an upper cooking surface 14 of the gas range 10. Gas to the burners 12 may be controlled by means of associated controls 16 accessible to a user at a front console 17 of the gas range. Each of the controls 16 may provide a knob 18 of conventional design having indicia indicating a setting of the control 16, for example, in a range from "off" to "high" and including an ignition position that may be momentarily achieved to activate an igniter at the burner 12.

[0030] Each control 16 may provide a valve stem 20 passing through an aperture in the front console 17 along a front to back axis 19 to communicate with the knob 18. The valve stem 20 is received by a knitting cover 22 of the control 16 that attaches to a valve body 24 extending rearwardly therefrom. A manifold connector 26 projects upward from the valve body 24 received by a gas supply manifold 28 in common with each of the valves and provides an inlet port for the valve. A burner gas line 30 may attach by threaded coupling 31 to a rear of the valve body 24 to conduct gas from the manifold 28 through the manifold connector 26 and out of the burner gas line 30 (providing an outlet port) when the control 16 is in positions other than "off".

[0031] A bottom of the knitting cover 22 provides a connector block 32 that may be connected with ignition wires 34 providing a source of electrical power to igniters (not shown) placed proximate to each of the burners 12.

[0032] Referring now to Fig. 2, the valve body 24 may provide for generally tapered bore 36 receiving a corresponding V-shaped frustoconical valve core 38 having interconnected radial and axial channels 40 that provide a passageway between the manifold connector 26 and the threaded coupling 31 when the core 38 is in a first position while providing gradual closure of that passageway as the valve core 38 is rotated to an off position.

[0033] A forward and larger diameter end of the valve core 38 provides for a keyed shaft 42 that may be received at a corresponding rearward coupling element 44 of the valve stem 20. The engagement between the rearward coupling element 44 and the keyed shaft 42 is such as to allow an axial sliding of the two while ensuring that they turn in unison.

[0034] A helical compression spring 46 fits coaxially about the keyed shaft 42 and provides a slight biasing in separation of the valve core 38 and coupling element 44 that ensures a good sealing of the valve core 38 against the bore 36.

[0035] The front end of the valve body 24 provides a flange 47 having axially directed threaded holes 48 which align with a corresponding flange 50 on a rear surface of the knitting cover 22 so that the two may be connected together by means of machine screws (not shown). The knitting cover 22 provides a generally larger diameter switch housing 52 capped at its

front end by a journal opening 54. A front smaller diameter portion of the valve stem 20 may pass snugly through the journal opening 54 to rotate therein while the knitting cover 22 retains the larger diametered coupling element 44 against further forward motion. Thus, when the knitting cover 22 is attached to the valve body 24, the compression spring 46 will press the valve core 38 rearwardly into the valve body 24 for a good seal.

[0036] The connector block 32 extending downward from the large diameter switch housing provides a set of upper and lower horizontally extending channels 56 that may receive the wires 34 therein to engage conductors of the wires 34 with bladed IDC elements 58 in-molded into the channels. Connector block 32 further includes a terminal block cover 59 that may snap down over the channels 56 to retain the wires 34 therein after the wires 34 are engaged with the IDC elements.

[0037] Referring now also to Fig. 3, each IDC element 58 provides generally a blade section 60 having a slotted blade open forward along axis 19 from the channels 56. The slotted blade provides a relatively wide channel section 62 sized to receive the outer diameter of the insulation 64 of the wires 34. This wide channel section 62 gives way to a relatively narrow channel section 65 slightly smaller than the outer diameter of the conductor 66. Pressing the wires 34 into the narrow channel section 65 removes the insulation 64 and makes a gas-tight seal between the conductor 66 of the wires 34 and the metal of the blade section 60.

[0038] The blade sections 60 may be constructed of a conductive metal such as a bronze or brass and may connect to a perpendicularly extending section 68 whose opposite end is bent backwards to present a contact surface 70 having a planar surface that will be positioned generally parallel to the axis 19.

[0039] Referring now to Figs. 2 and 4, the coupling element 44 at the rear of the valve stem 20 may support on its outer periphery a pair of electrically communicating bifurcated contact fingers 72 formed, for example, from a metal stamping. The fingers 72 are cantilevered levers that provide contacts on the ends of the fingers 72 with a radial outward spring bias. The contacts on fingers 72 may ride along the inside surface of the larger diameter switch housing 52 of the knitting cover 22 for most of the annular rotation of the valve stem 20 but at an ignition position will contact the contact surfaces 70 of the two IDC elements to join them together, thus allowing conduction of electrical power from one power wire 34 to an ignition wire 34'. In this respect, the finger 72 and the contact surfaces 70 provide for inter-engaging switch contact elements. The fingers 72 move about a circle centered on rotational axis 19 to wipe across the contact surfaces 70 with rotation of the valve stem 20.

[0040] The coupling element 44 may include features preventing the valve stem 20 from remaining in the ignition position, for example a ramp (not shown), that operates with

compression spring 46 to move the valve stem 20 away from the ignition position once the user's hand has been removed from the knob 18.

[0041] Referring still to Figs. 2 and 3, a set of teeth 76 may project from sides of the connector block 32 to engage corresponding aperture sockets 78 in the terminal block cover 59 when the terminal block cover 39 is placed over the channels 56 to provide a snap connector engageable simply by placement of the terminal block cover 39 in position and pressing it into engagement with the teeth 76.

[0042] Referring now to Fig. 5, the controls 16 of the present invention allow installation of the controls 16 on to the manifold 28 (before or after installation of the manifold 28 in the gas range 10) by attaching each of the manifold connectors 26 shown in Fig. 2 to the manifold 28. The wires 34 may then be installed in the channels 56, the latter securely supported by the manifold 28. Because the controls 16 are already in place on the manifold 28, the excess wire length normally needed for a harness is eliminated allowing simple daisychain connection of each successive control 16, one at the time, followed by a removing of slack from the wires 34 and threading them into the channels 56 of this next control 16 to be received by the IDC elements 58 of that control 16. Covers 59 may then be installed. The need for multiple different harnesses for different numbers and types of switches is also reduced.

[0043] Variations and modifications of the foregoing are within the scope of the present invention. It is understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention. The claims are to be construed to include alternative embodiments to the extent permitted by the prior art.

[0044] Various features of the invention are set forth in the following claims.

CLAIMS

What is claimed is:

1. An integrated gas valve ignitor switch comprising:

a gas valve providing a housing supporting a valve core therein, the valve core rotatable by a valve stem between a range of open positions where the valve core receives a gas flow through an inlet port in the housing and conducts the gas flow through the valve core to an outlet port in the housing and a close position where the valve core blocks gas flow between the inlet port and outlet port;

an electrical switch fixed with respect to the housing and communicating with the valve stem to provide an electrical switching of at least one open position for activation of the gas ignitor; and

at least two insulation displacement connectors fixed with respect to the housing to provide an electrical connection between the switch and a first and second insulated conductor.

2. The integrated gas valve ignitor switch of claim 1 further including a cover fitting over the insulation displacement connectors when they receive the first and second insulated conductors.

3. The integrated gas valve ignitor switch of claim 1 wherein the insulation displacement conductors provide a slot sized to displace insulation from the first or second insulated conductor to make electrical contact with a contained conductive core and wherein the first and second insulation displacement connectors fit within longitudinal channels with the slot oriented perpendicularly to the channel to receive the first and second insulated conductors extending along the channel.

4. The integrated gas valve ignitor switch of claim 3 wherein the channels extend substantially perpendicularly to an extent of the valve stem.

5. The integrated gas valve ignitor switch of claim 3 further including a cover fitting over the insulation displacement connectors and the channels when they receive the first and second insulated conductors.

6. The integrated gas valve ignitor switch of claim 5 wherein the cover is held by a snap connection.

7. The integrated gas valve ignitor switch of claim 6 wherein the snap connection consists of inter-engaging teeth and sockets.

8. The integrated gas valve ignitor switch of claim 3 further including a manifold attaching to the housing to extend substantially perpendicularly to an extent of the valve stem is communicate with the inlet port at one of multiple manifold ports.

9. The integrated gas valve ignitor switch of claim 1 wherein the insulation displacement conductors provide first contact elements for the electrical switch that engage and disengage with movable second contact elements rotating with the valve stem.

10. The integrated gas valve ignitor switch of claim 9 wherein the first contact elements are tangential to a circle centered on a rotational axis of the valve stem and the second contact elements move along the circle to wipe across the first contact elements with rotation of the valve stem.

11. The integrated gas valve ignitor switch of claim 9 wherein the insulation displacement conductors are single piece metal stampings.

12. The integrated gas valve ignitor switch of claim 1 wherein the electrical switch includes an injection molded thermoplastic housing supporting electrical contacts and the insulation displacement connectors.

13. The integrated gas valve ignitor switch of claim 12 wherein the insulation displacement conductors are in-molded to the thermoplastic housing

14. A method of assembling a gas stove comprising the steps of:

(a) assembling a plurality of integrated gas valve ignitor switches to a manifold, each integrated gas valve ignitor switch providing:

(i) a gas valve providing a housing supporting a valve core therein, the valve core rotatable by a valve stem between a range of open positions where the valve core receives a gas flow through an inlet port in the housing and conducts the gas flow through the valve core to an outlet port in the housing and a close position where the valve core blocks gas flow between the inlet port and outlet port;

(ii) an electrical switch fixed with respect to the housing and communicating with the valve stem to provide an electrical switching of at least one open position for activation of the gas ignitor; and

(iii) at least two insulation displacement connectors fixed with respect to the housing to provide an electrical connection between the switch and a first and second insulated conductor;

the manifold providing a conduit having spaced ports attachable to the inlet ports of the integrated gas valve ignitor switches; and

(b) after the assembly of step (a), inserting two conductors in daisychain fashion to interconnect corresponding IDC elements of each of the integrated gas valve ignitor switches.

15. The method of claim 14 further including the step of installing insulating covers over the IDC elements.

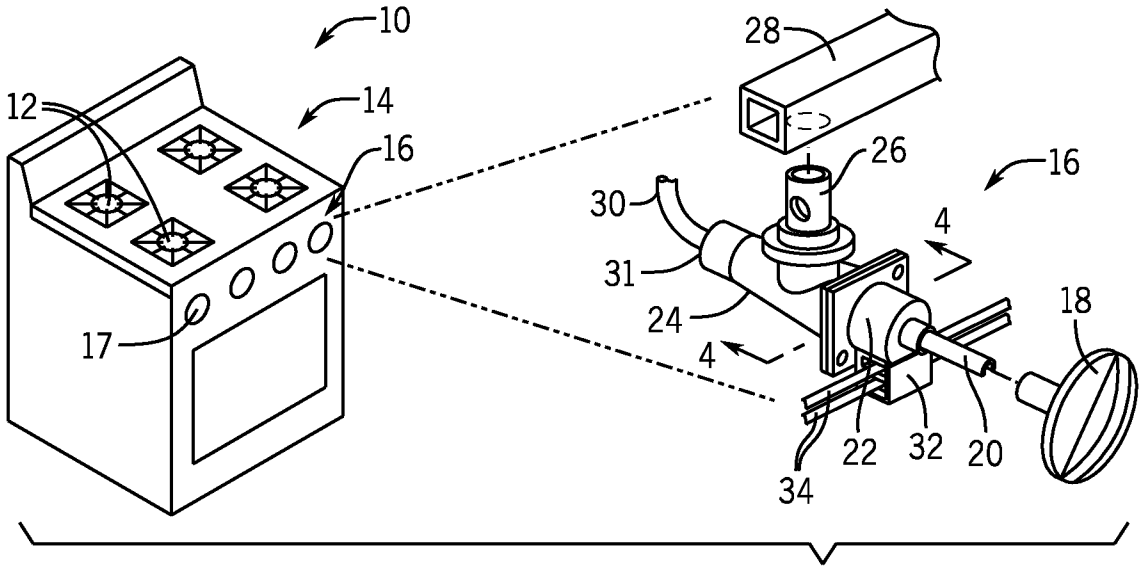


FIG. 1

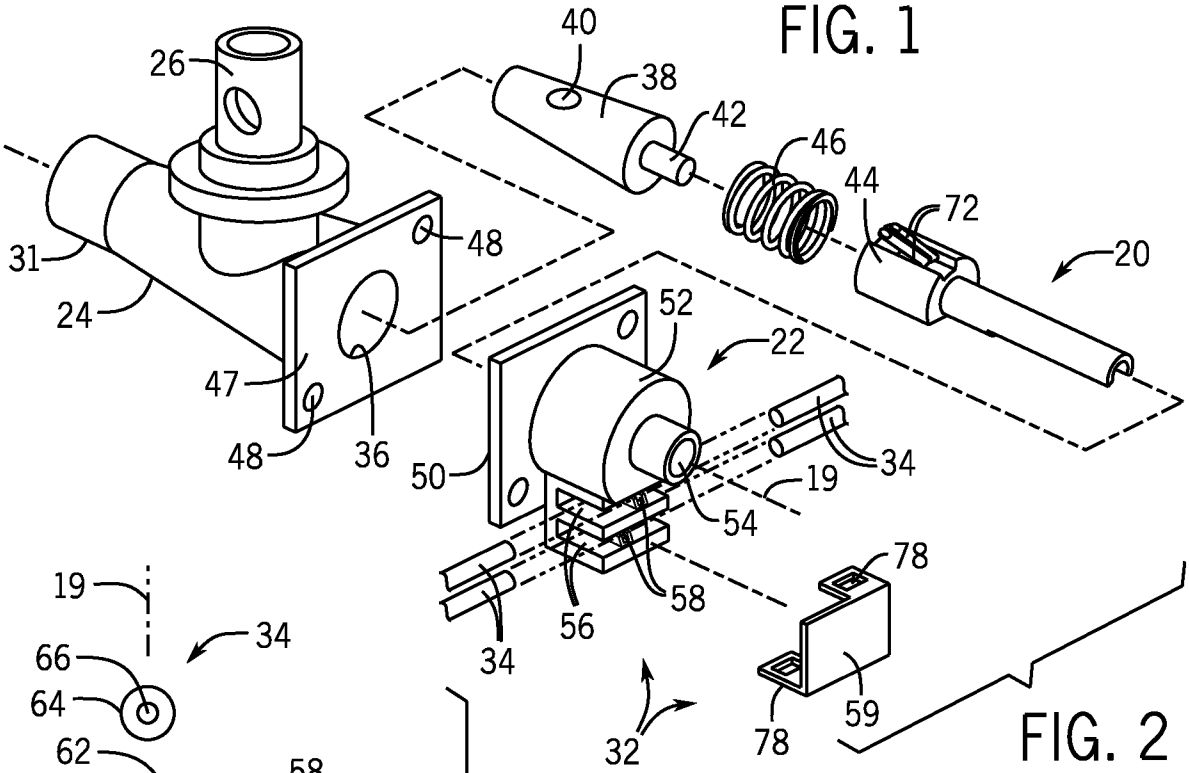


FIG. 2

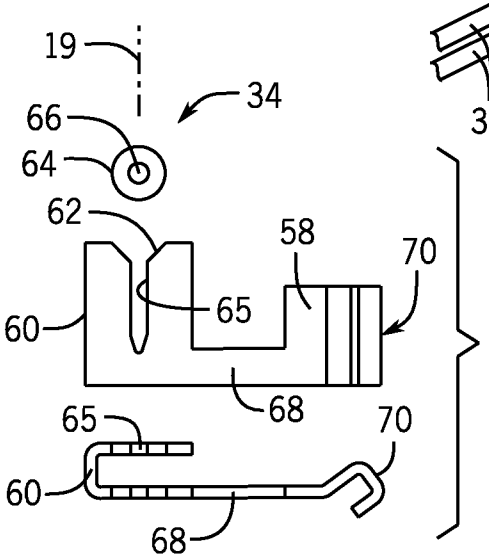


FIG. 3

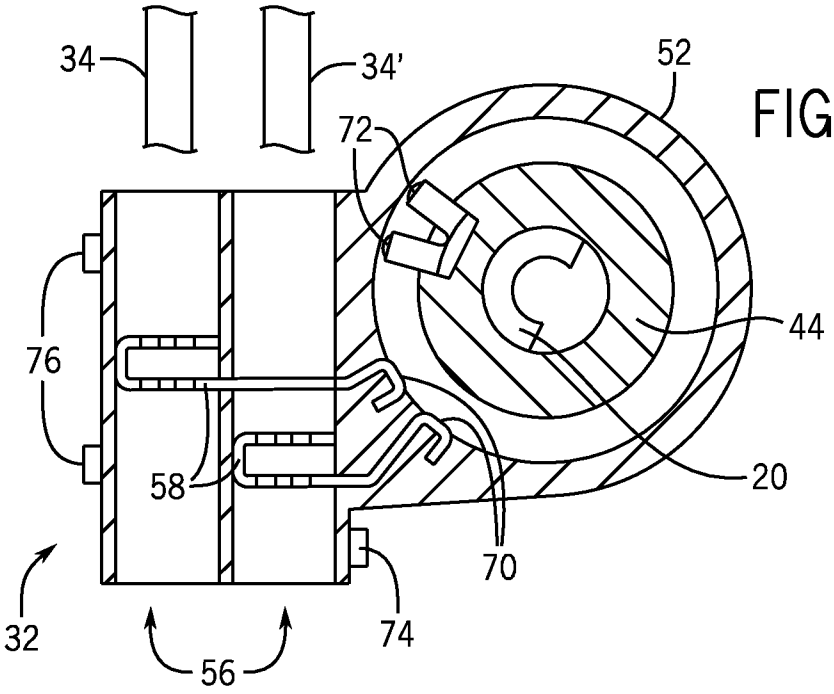

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FIG. 4

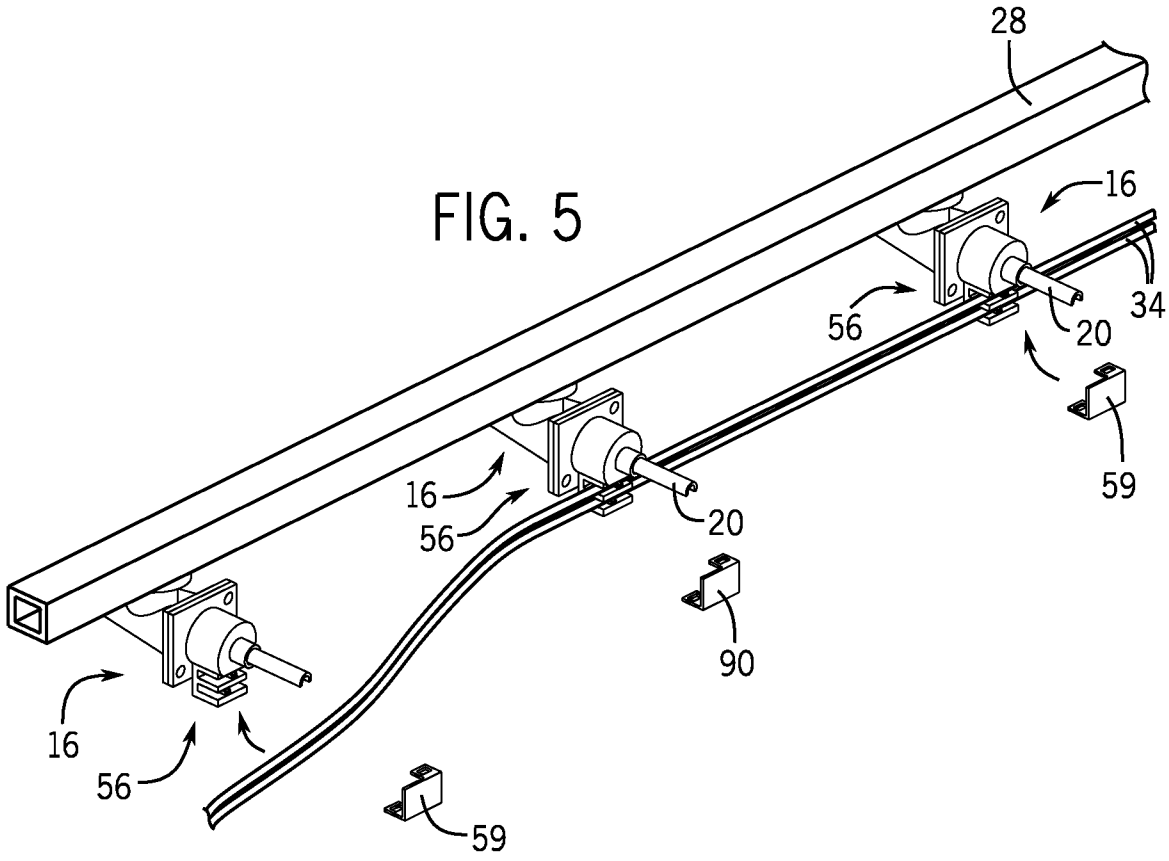

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FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/063343

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01H3/02 F24C3/12
ADD.

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)
F24C H01H F23N F23Q

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 096 987 A (KRUEGER DONALD M [US] ET AL) 1 August 2000 (2000-08-01) column 2, line 33 - column 3, line 66; figures 1-4	1-15
X	WO 2008/002863 A2 (ILLINOIS TOOL WORKS [US]; TEGEL ROBERT G [US]; DAM ROBERT [US]; HARTLE) 3 January 2008 (2008-01-03)	1
A	page 2 - page 4; figures 3,9,14	2-15
X	US 2008/003532 A1 (GJERDE RICHARD D [US] ET AL) 3 January 2008 (2008-01-03)	1
A	page 1 - page 3; figures 2,3,6,7	2-15
X	US 2006/042925 A1 (GJERDE RICHARD D [US]) 2 March 2006 (2006-03-02)	1
A	paragraph [0022] - paragraph [0035]; figures 1-4	2-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
15 January 2014	23/01/2014

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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