PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

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Applicant's or agent's file reference	FOR FURTHER ACTION
008496-8147	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 20/30781	30 April 2020 (30.04.2020)	02 May 2019 (02.05.2019)

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

IPC - F16K 17/00, F16K 1/00, F16K 7/00, F16K 15/00, F16K 31/00, F15B 20/00 (2020.01)

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Applicant ENGINEERED CONTROLS INTERNATIONAL, LLC

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [x] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	01 July 2020	Lee Young PCT Help Desk Telephone No. 571-272-4300

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(b)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

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Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	None	NO
Inventive step (IS)	Claims	4-6, 9, 11-15, 19	YES
	Claims	1-3, 7-8, 10, 16-18, 20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-3, 7-8, 10, 16-18, 20 lack an inventive step under PCT Article 33(3) as being obvious over US 2010/0224804 A1 to Sneh in view of GB 2359891 A to Medem (UK) Limited (hereinafter Medem).

As per claim 1, Sneh discloses a pressurized-gas low-pressure detection and shut-off system (Abstract), comprising:
a low-pressure shut-off valve (valve 200 except pneumatic manifold 160', Fig. 1c; Abstract; para [0078]) including a first valve inlet (inlet passage 104 (Fig. 1a, unnumbered in Fig. 1c); para [0072]), a second valve inlet (feed inlet 116', Fig. 1c; para [0078]) and at least one valve outlet (outlet passage 106 (unnumbered in Fig. 1c), Fig. 1a; para [0072]);
a solenoid valve (solenoid valve 144', Fig. 1c; para [0078]) including a valve inlet (inlet 286, Fig. 1c; para [0078]), a first valve outlet (vent outlet 290, Fig. 1c; para [0078]), and a second valve outlet (a second valve outlet is defined at supply line 154', Fig. 1c; para [0078]), the second valve outlet connected to and in fluid communication with the first valve inlet of the low-pressure shut-off valve (see Fig. 1c; para [0078]), the solenoid valve configured to direct a flow of a pressurized gas from the valve inlet into at least one of the first valve outlet and the second valve outlet (see Fig. 1c; para [0078]);
but does not explicitly disclose:
a gas monitor electrically coupled to the solenoid valve, wherein the gas monitor is configured to transmit one of a first signal and a second signal to the solenoid valve to control the flow of the pressurized gas through the solenoid valve.
However, Medem teaches a gas pressure monitoring system (see Fig. 1, Abstract) comprising a shut-off valve (cut-off valve 14, Fig. 1; Abstract; see p. 3 of specification) controlled by a solenoid (solenoid 22, Fig. 1; see p. 3 of specification), a gas monitor electrically coupled to the solenoid (a gas monitor is comprised of pressure transducers 15-16 and control unit 20, Fig. 1; see p. 3 of specification), wherein the gas monitor is configured to transmit one of a first signal and a second signal to the solenoid to control the flow of the pressurized gas via the solenoid (the gas monitor is configured to send 'open' or 'closed' signals to solenoid 22, thereby controlling pressurized gas flow through valves 14, 24, Fig. 1; see p. 3 of specification). Accordingly, it would have been obvious to a person having ordinary skill in the art to have employed gas monitoring means, as taught by Medem, in the system disclosed by Sneh to allow for more accurate control and improved safety.

As per claim 2, Sneh in view of Medem discloses the pressurized-gas low-pressure detection and shut-off system of claim 1, wherein the first signal from the gas monitor is configured to control the solenoid valve to direct the flow of the pressurized gas through the first valve outlet of the solenoid valve (the gas monitor disclosed by Medem is configured to send 'open' or 'closed' signals to a solenoid, thereby controlling pressurized gas flow through valves; accordingly, a first signal can be defined as that which would actuate solenoid valve 144' of Sneh to exhaust through vent outlet 290, Fig. 1c; paras [0078-0080]).

As per claim 3, Sneh in view of Medem discloses the pressurized-gas low-pressure detection and shut-off system of claim 1, wherein the second signal from the gas monitor is configured to control the solenoid valve to direct the flow of the pressurized gas through the second valve outlet of the solenoid valve and into the first valve inlet of the low-pressure shut-off valve (the gas monitor disclosed by Medem is configured to send 'open' or 'closed' signals to a solenoid, thereby controlling pressurized gas flow through valves; accordingly, a second signal can be defined as that which would actuate solenoid valve 144' of Sneh to direct gas through supply line 154' to feed inlet 116', Fig. 1c; para [0078]).

-*-Continued in Supplemental Box-*-

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claim 16: Regarding claim 16, the claim language appears to contain a typographical error inconsistent with the teachings of the figures and written specification provided by the applicant. Specifically, the recitation "the solenoid valve is configured to prevent the shut-off valve from providing the pressurized fluid to the pressurized-fluid consuming device when the solenoid inlet is closed from the solenoid outlet" is at odds with the system described in the instant application (see Figs. 2, 5; paras [0061], [0065], [0068-0069]). As can best be determined in light of the provided specification and figures, the word "prevent" should be revised to read "permit." Accordingly, for the purposes of this opinion, the recitation in question has been revised to read "the solenoid valve is configured to permit the shut-off valve to provide the pressurized fluid to the pressurized-fluid consuming device when the solenoid inlet is closed from the solenoid outlet."

Claim 17: Regarding claim 17, the claim language appears to contain a typographical error inconsistent with the teachings of the figures and written specification provided by the applicant. Specifically, the recitation "the solenoid valve is configured to permit the shut-off valve to provide the pressurized fluid to the pressurized-fluid consuming device when the solenoid inlet is in fluid communication with the solenoid outlet" is at odds with the system described in the instant application (see Figs. 2, 5; paras [0061], [0065], [0068-0069]). As can best be determined in light of the provided specification and figures, the word "permit" should be revised to read " prevent." Accordingly, for the purposes of this opinion, the recitation in question has been revised to read "the solenoid valve is configured to prevent the shut-off valve from providing the pressurized fluid to the pressurized-fluid consuming device when the solenoid inlet is in fluid communication with the solenoid outlet."

Claim 20: Regarding claim 20, the claim language appears to contain a typographical error inconsistent with the preceding claims and the teachings of the figures and written specification provided by the applicant. Specifically, the recitation "the seat disc diaphragm connected to the piston is configured to open in response to pressure on the first side" is at odds with the preceding claim and the system described in the instant application (see Figs. 2-3; para [0066]). As can best be determined in light of the provided specification and figures, the term "first side" should be revised to read "second side." Accordingly, for the purposes of this opinion, the recitation in question has been revised to read "the seat disc diaphragm connected to the piston is configured to open in response to pressure on the second side."

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Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
-*-Box V.2 - Citations and Explanations-*-

As per claim 7, Sneh discloses a pressurized-fluid low-pressure detection and shut-off system (Abstract), comprising:
a low-pressure shut-off valve (valve 200 except pneumatic manifold 160', Fig. 1c; Abstract; para [0078]) including:
a first shut-off inlet (feed inlet 116', Fig. 1c; para [0078]);
a second shut-off inlet (inlet passage 104 (unnumbered in Fig. 1c), Fig. 1a; para [0072]) configured to receive pressurized fluid from a pressurized fluid source (pneumatic line 146', Fig. 1c; para [0078]); and
a shut-off outlet (outlet passage 106 (unnumbered in Fig. 1c), Fig. 1a; para [0072]) configured to provide the pressurized fluid to a pressurized-fluid consuming device (Note: Intended Use);
a solenoid valve (solenoid valve 144', Fig. 1c; para [0078]) including:
a solenoid inlet configured to receive the pressurized fluid (inlet 286, Fig. 1c; para [0078]); and
a solenoid outlet (a solenoid outlet is defined at supply line 154', Fig. 1c; para [0078]) configured to fluidly connect to the first shut-off inlet of the low-pressure shut-off valve (see Fig. 1c; para [0078]), wherein the solenoid valve is configured to selectively permit fluid flow, directing the pressurized fluid from the solenoid inlet to the solenoid outlet (see Fig. 1c; para [0078]);
but does not explicitly disclose:
a gas monitor electrically coupled to the solenoid valve, wherein the gas monitor is configured to transmit one of a first signal and a second signal to the solenoid valve to control the flow of the pressurized fluid to the pressurized-fluid consuming device via the shut-off valve.
However, Medem teaches a gas pressure monitoring system (see Fig. 1, Abstract) comprising a shut-off valve (cut-off valve 14, Fig. 1; Abstract; see p. 3 of specification) controlled by a solenoid (solenoid 22, Fig. 1; see p. 3 of specification), a gas monitor electrically coupled to the solenoid (a gas monitor is comprised of pressure transducers 15-16 and control unit 20, Fig. 1; see p. 3 of specification), wherein the gas monitor is configured to transmit one of a first signal and a second signal to the solenoid to control the flow of the pressurized gas via the solenoid (the gas monitor is configured to send 'open' or 'closed' signals to solenoid 22, thereby controlling pressurized gas flow through valves 14, 24, Fig. 1; see p. 3 of specification). Accordingly, it would have been obvious to a person having ordinary skill in the art to have employed gas monitoring means, as taught by Medem, in the system disclosed by Sneh to allow for more accurate control and improved safety.

As per claim 8, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 7, wherein the solenoid inlet is configured to fluidly connect to the pressurized fluid source via a fluid pathway external to the low-pressure shut-off valve to receive the pressurized fluid (intended use: Sneh; see line 152', Fig 1c; para [0078])

As per claim 10, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 7, wherein the solenoid valve is a normally-closed 3-way solenoid valve and includes a second solenoid outlet that defines a relief port (Sneh; solenoid valve 144' is a 3-way valve wherein a second solenoid outlet defining a relief port is defined by vent outlet 290, which is held in a 'normally closed' position by spring 282, Fig. 1c; para [0078]).

As per claim 16, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 7, wherein the solenoid valve is configured to permit the shut-off valve to provide the pressurized fluid to the pressurized-fluid consuming device when the solenoid inlet is closed from the solenoid outlet (Note: See Box VIII) (intended use: Sneh; when inlet 286 of solenoid valve 144' is closed, fluid control chamber 114 is no longer being actively pressurized and diaphragm 108 may be overcome and bypassed by fluid flowing through valve 200, Fig. 1c; para [0078]).

As per claim 17, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 16, wherein the solenoid valve is configured to prevent the shut-off valve from providing the pressurized fluid to the pressurized-fluid consuming device when the solenoid inlet is in fluid communication with the solenoid outlet (intended use: Sneh; when inlet 286 of solenoid valve 144' is open, fluid control chamber 114 is actively pressurized and diaphragm 108 may be not overcome by fluid flowing through valve 200, Fig. 1c; para [0078]).

As per claim 18, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 7, wherein the low-pressure shut-off valve further includes a piston (Sneh; see piston comprised of component 120 and the unnumbered coupler to stem 118, Figs. 1a, 1c; para [0074]), a seat disc diaphragm connected to the piston (Sneh; diaphragm 108 is selectively connected to said piston, Figs. 1a, 1c; para [0074]), and a spring biasing the piston (Sneh; spring 128, Figs. 1a, 1c; para [0074]), wherein the spring and the first shut-off inlet are located on a first side of the piston (Sneh; the spring and the first shut-off inlet are located above the piston, Fig. 1c), wherein the second shut-off inlet is located on an opposing second side of the piston (Sneh; the second shut-off inlet is located below the piston, Fig. 1c).

As per claim 20, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 18, wherein, when the solenoid valve prevents the solenoid outlet from providing the pressurized fluid to the first shut-off inlet of the low-pressure shut-off valve, the seat disc diaphragm connected to the piston is configured to open in response to pressure on the second side (Note: See Box VIII) of the piston (Sneh; when inlet 286 of solenoid valve 144' is closed, fluid control chamber 114 is no longer being actively pressurized and diaphragm 108 may be overcome and bypassed in response to pressure from fluid flowing through valve 200, Fig. 1c; para [0078]) exceeding a predefined pressure threshold associated with a biasing force of the spring (Note: Inherent), wherein the shut-off outlet is configured to provide the pressurized fluid to the pressurized-fluid consuming device when the seat disc diaphragm of the shut-off valve is open (Note: Intended Use).

-*-Continued in next Supplemental Box-*-

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Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
-*-Supplemental Box - Box V.2 - Citations and Explanations-*-

Claims 4-6, 9, 11-15, 19 meet the criteria of PCT Article 33(2) and 33(3) because the prior art does not teach nor does it fairly suggest the low-pressure shut-off valve and system as claimed by the applicant.

The prior art is exemplified by (1) Sneh; (2) Medem;

(1) Sneh teaches a fail-safe pneumatically-operated diaphragm valve.

(2) Medem teaches a gas distribution system incorporating means for monitoring the operational status of the gas.

As per claim 4, Sneh in view of Medem discloses the pressurized-gas low-pressure detection and shut-off system of claim 1, but fails to disclose that the gas monitor is configured to detect one of a normal amount of CO2 in an area surrounding the gas monitor and an elevated amount of CO2 in the area surrounding the gas monitor.

No prior art teaches, nor fairly suggests, the pressurized-gas low-pressure detection and shut-off system of claim 4. Specifically, no prior art teaches, alone or in combination, the system disclosed in claim 1 further comprising means for detecting elevated amounts of CO2 in the surrounding area.

As per claims 5-6, the prior art does not teach, nor does it fairly suggest, the pressurized-gas low-pressure detection and shut-off system as claimed by the applicant, as they are dependent upon claim 4.

As per claim 9, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 7, but fails to disclose that the low-pressure shut-off valve includes a second shut-off outlet that is fluidly connected to the second shut-off inlet and is configured to fluidly connect to the solenoid inlet to provide the pressurized fluid to the solenoid valve.

No prior art teaches, nor fairly suggests, the pressurized-gas low-pressure detection and shut-off system of claim 9. Specifically, no prior art teaches, alone or in combination, the system disclosed in the preceding claims further comprising a second shut-off outlet configured as described by the applicant.

As per claim 11, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 7, but fails to disclose that pressurized fluid is pressurized CO2 and the gas monitor is configured to collect a CO2 measurement of CO2 in an area surrounding the gas monitor.

No prior art teaches, nor fairly suggests, the pressurized-gas low-pressure detection and shut-off system of claim 11. Specifically, no prior art teaches, alone or in combination, the system disclosed in the preceding claims further comprising means for collecting and measuring amounts of CO2 in the surrounding area.

As per claims 12-15, the prior art does not teach, nor does it fairly suggest, the pressurized-gas low-pressure detection and shut-off system as claimed by the applicant, as they are dependent upon claim 11.

As per claim 19, Sneh in view of Medem discloses the pressurized-fluid low-pressure detection and shut-off system of claim 18, but fails to disclose that when the solenoid outlet of the solenoid valve provides the pressurized fluid to the first shut-off inlet of the low-pressure shut-off valve, pressure is equalized between the first side and the second side of the piston to cause the spring to close the seat disc diaphragm connected to the piston and prevent the shut-off outlet from providing the pressurized fluid to the pressurized fluid consuming device.

No prior art teaches, nor fairly suggests, the pressurized-gas low-pressure detection and shut-off system of claim 19. Specifically, no prior art teaches, alone or in combination, the system disclosed in the preceding claims wherein the solenoid valve is configured to facilitate pressure equalization on both sides of the diaphragm, as described by the applicant.

Claims 1-20 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used by industry.