(12) **United States Patent**
Santilli

(10) **Patent No.:** **US 9,700,870 B2**
(45) **Date of Patent:** **Jul. 11, 2017**

(54) **METHOD AND APPARATUS FOR THE INDUSTRIAL PRODUCTION OF NEW HYDROGEN-RICH FUELS**

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(72) Inventor: **Ruggero Maria Santilli,** Palm Harbor, FL (US)

(73) Assignee: **MAGNEGAS CORPORATION,** Clearwater, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/244,229**

(22) Filed: **Apr. 3, 2014**

(65) **Prior Publication Data**

US 2014/0299463 A1 Oct. 9, 2014

Related U.S. Application Data

(60) Provisional application No. 61/808,951, filed on Apr. 5, 2013.

(51) **Int. Cl.**
B01J 19/12 (2006.01)

(52) **U.S. Cl.**
CPC **B01J 19/12** (2013.01); *B01J 2219/0886* (2013.01); *B01J 2219/12* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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|				
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Primary Examiner — Kishor Mayekar
(74) *Attorney, Agent, or Firm* — Larson & Larson, P.A.; Frank Liebenow

(57) **ABSTRACT**

A method with various related apparatus polarizes the orbits of atomic electrons by strong magnetic fields creating in the atomic structure a magnetic field. The polarized atoms are introduced onto fuels, improving an efficiency of the fuels, including but not limiting to, new forms of gaseous, liquid and solid fuels with a bonded-in content of Hydrogen, Oxygen and/or other gases to enhance energy output and decrease contaminants in the exhaust. Further, methods of coating computer chips and other surfaces for their protection against oxidation, new fuels with energy content and flame temperatures greater than those of the conventional form of the same fuels, etc.

12 Claims, 54 Drawing Sheets
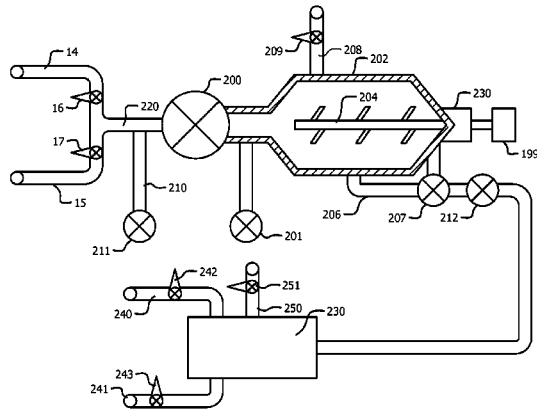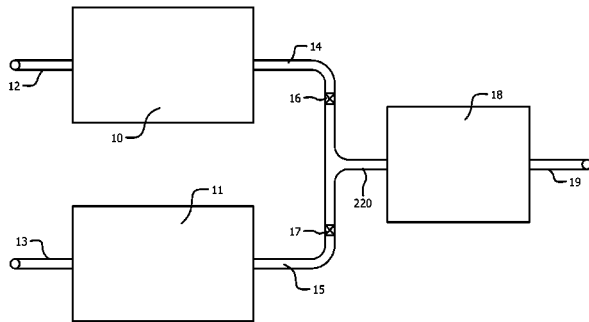
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Fig. 1

DC ARC
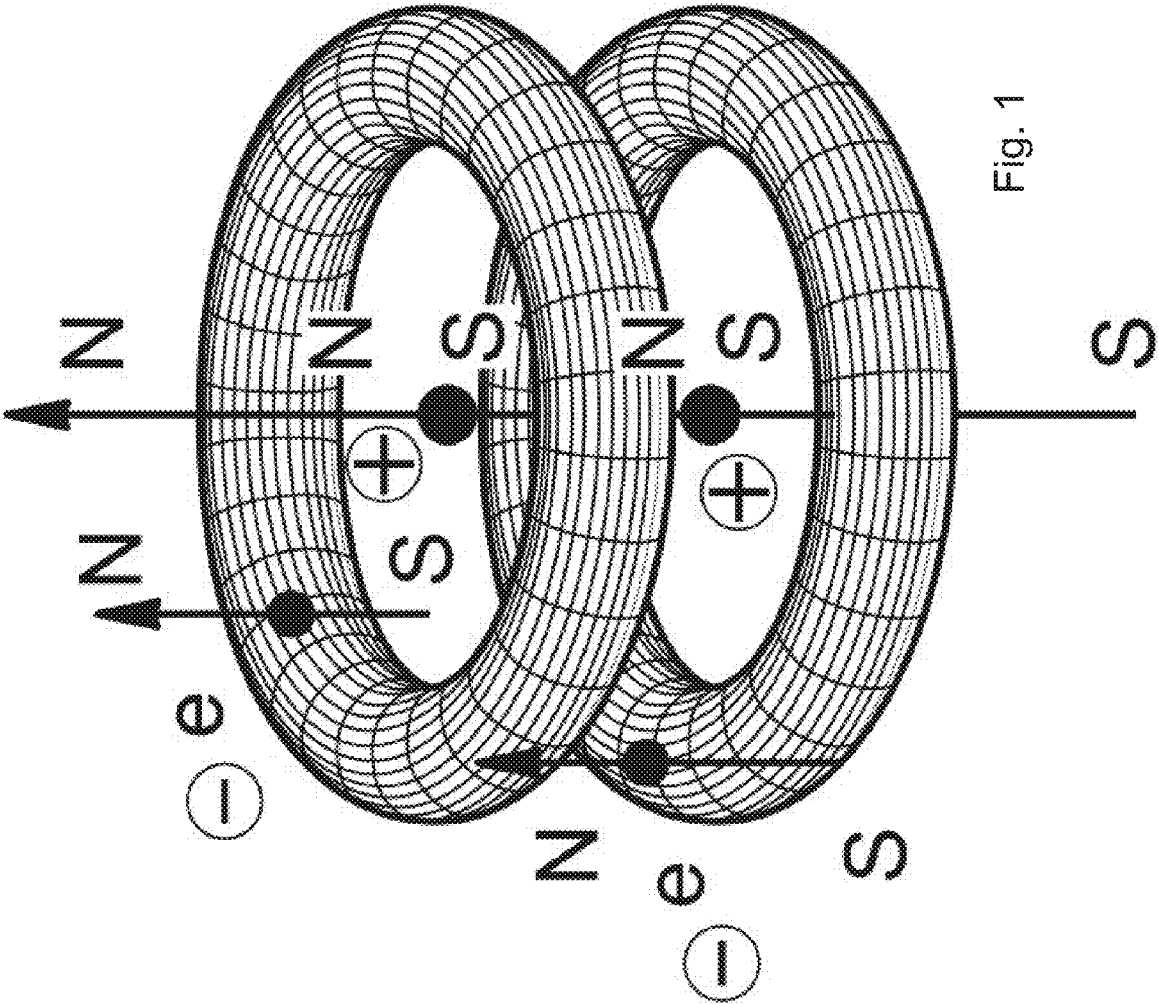
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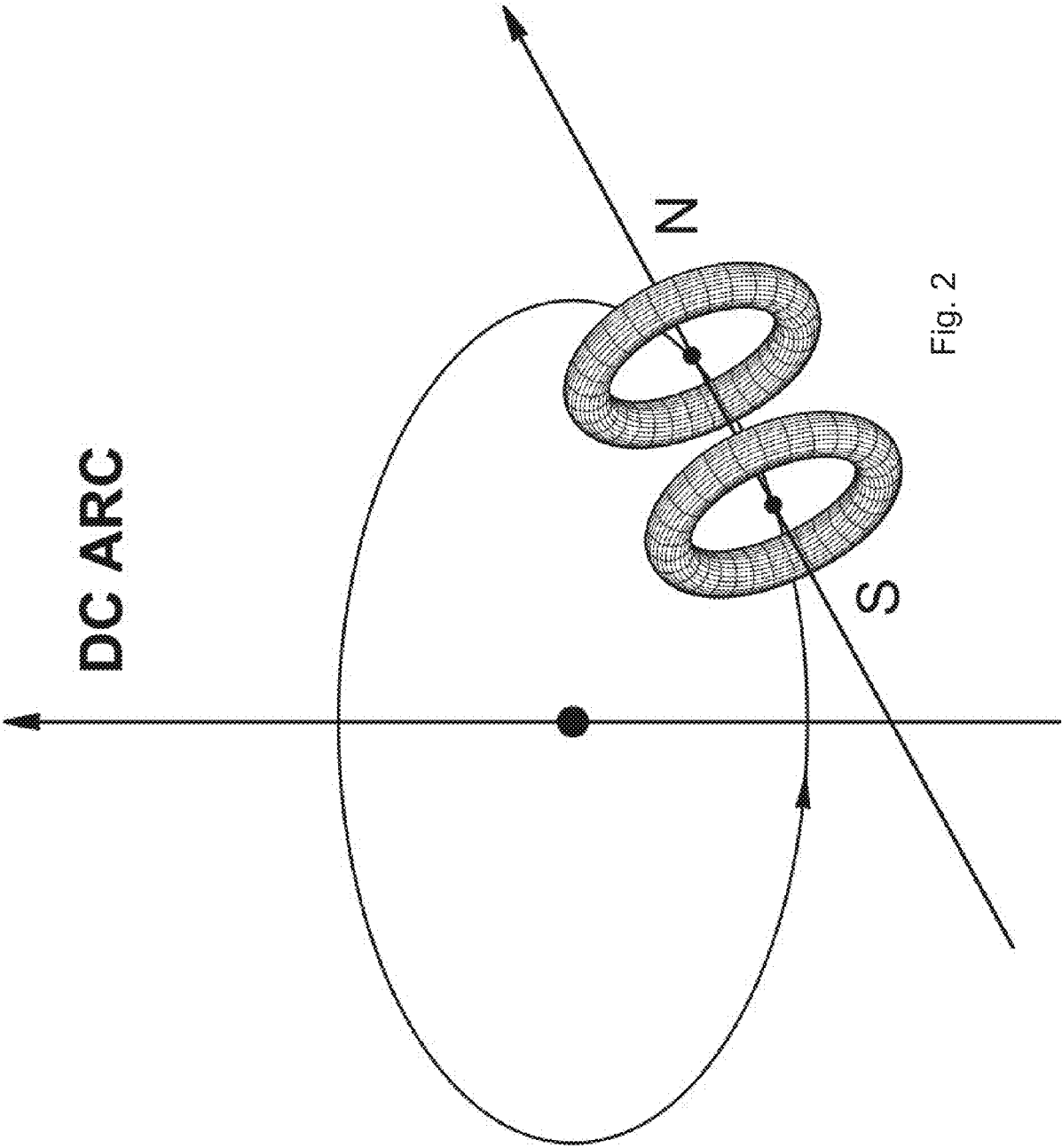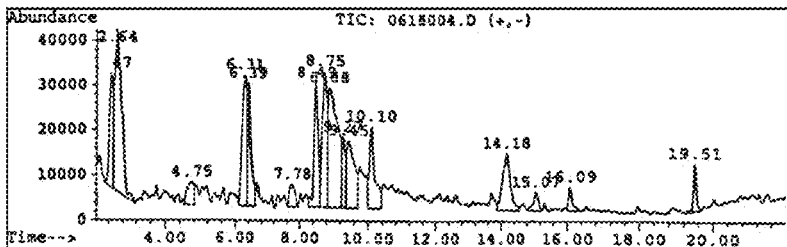Fig. 2

Information from Data File:
File   : C:\HPCHEM\1\DATA\0618004.D
Operator   : NAW
Acquired   : 18 Jun 98   3:01 pm using AcqMethod VOC_IRMS
Sample Name: TOUP'S TECH
Misc Info : 1ML LOOP; 10C @ ULTRA COLUMN
Vial Number: 1
CurrentMeth: C:\HPCHEM\1\METHODS\DEFAULT.M

Retention Time	Area	Area %	Ratio %
Total Ion Chromatogram			
2.474	1753306	5.386	32.724
2.644	5091514	15.641	95.030
4.754	641528	1.971	11.974
6.307	2717749	8.411	51.098
6.390	2211258	6.793	41.272
7.782	592472	1.820	11.058
8.490	2357396	7.242	43.999
8.754	2784829	8.555	51.977
8.882	5357812	16.460	100.000
9.265	1123609	3.452	20.975
9.448	2421234	7.438	45.191
10.098	1946292	5.979	36.326
14.177	2129791	6.543	39.751
15.073	435208	1.337	8.123
16.085	389822	1.198	7.276
19.509	577433	1.774	10.777

Fig. 3
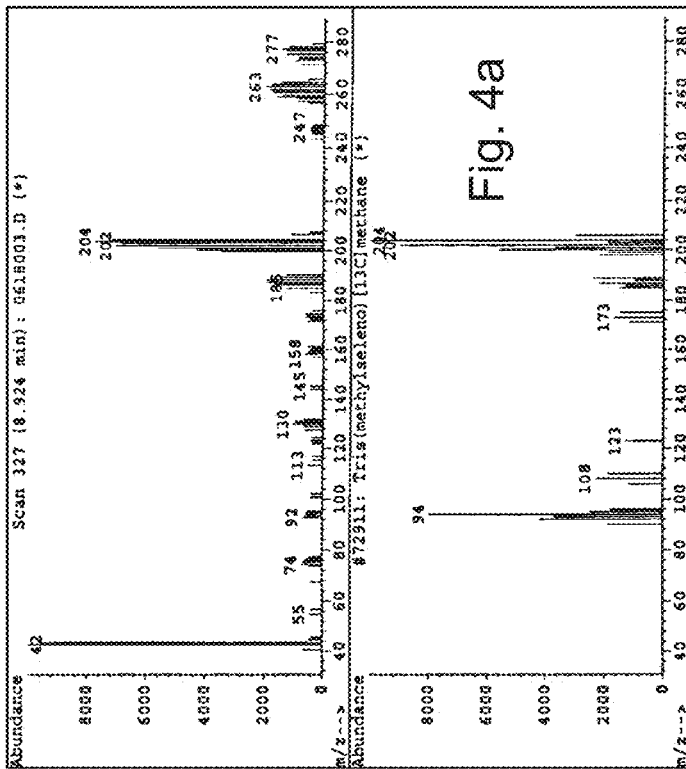
Fig. 4a

Fig. 4b

Fig. 5
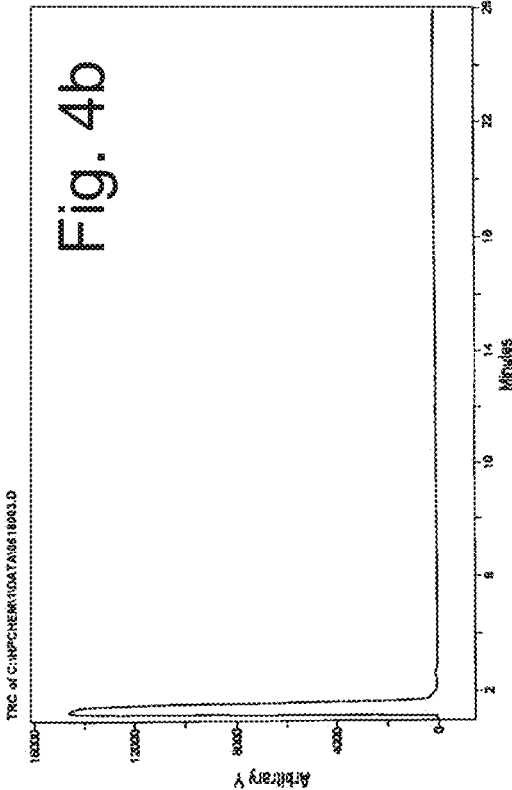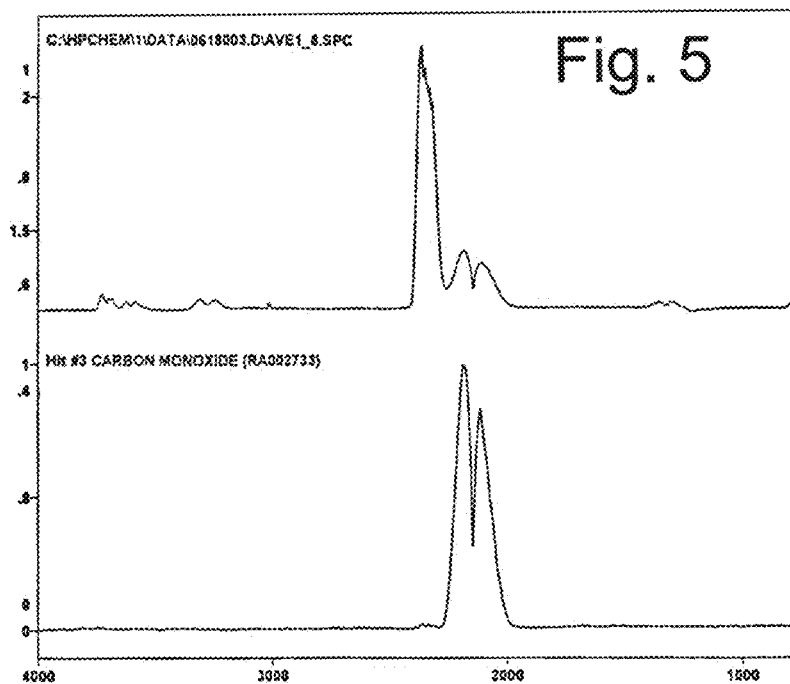
Fig. 6a

Fig. 6b

Fig. 7a

Fig. 7b

Fig. 8a

Fig. 8b

Fig. 9a

Fig. 9b

Fig. 10a

Fig. 10b
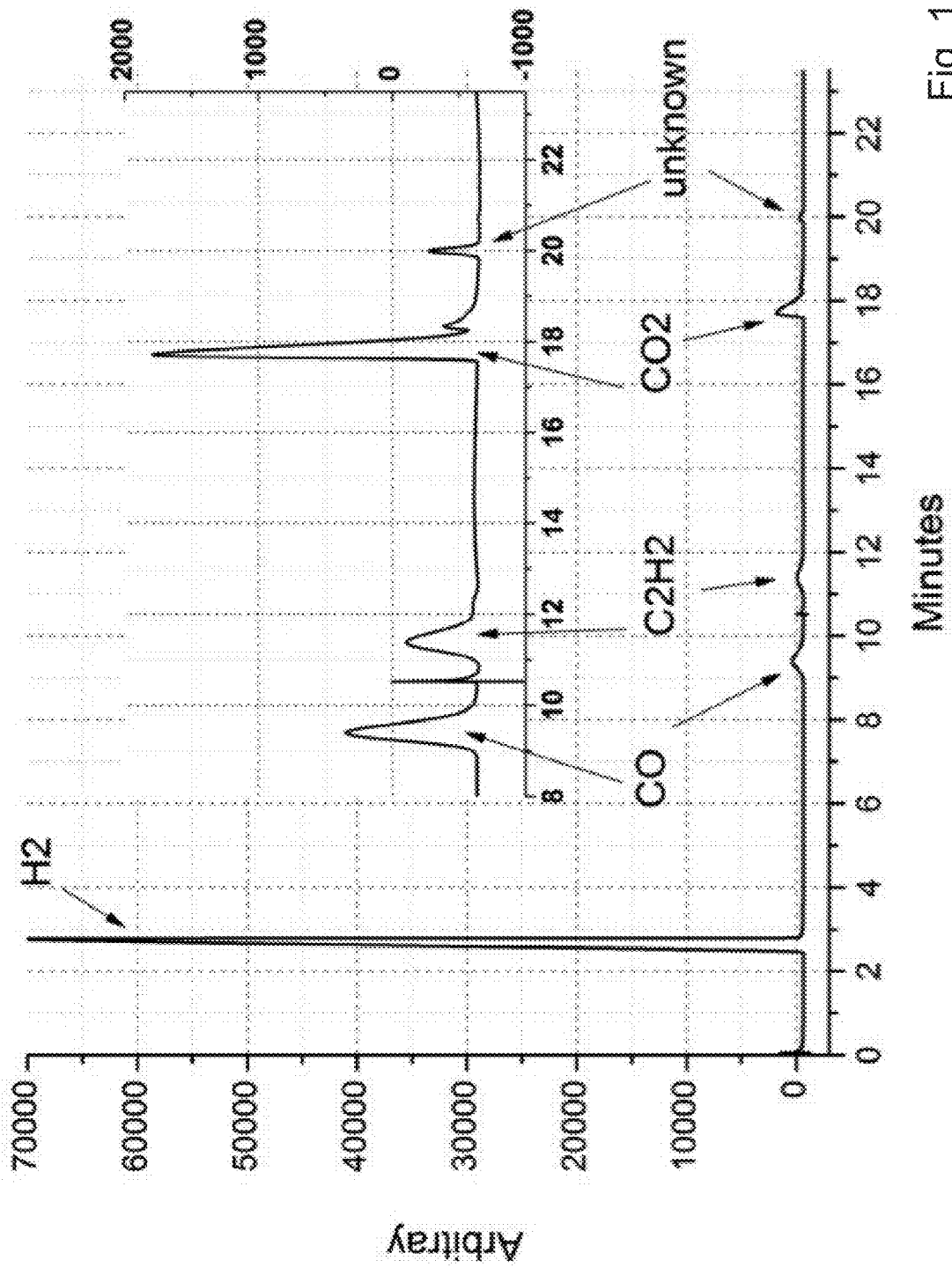
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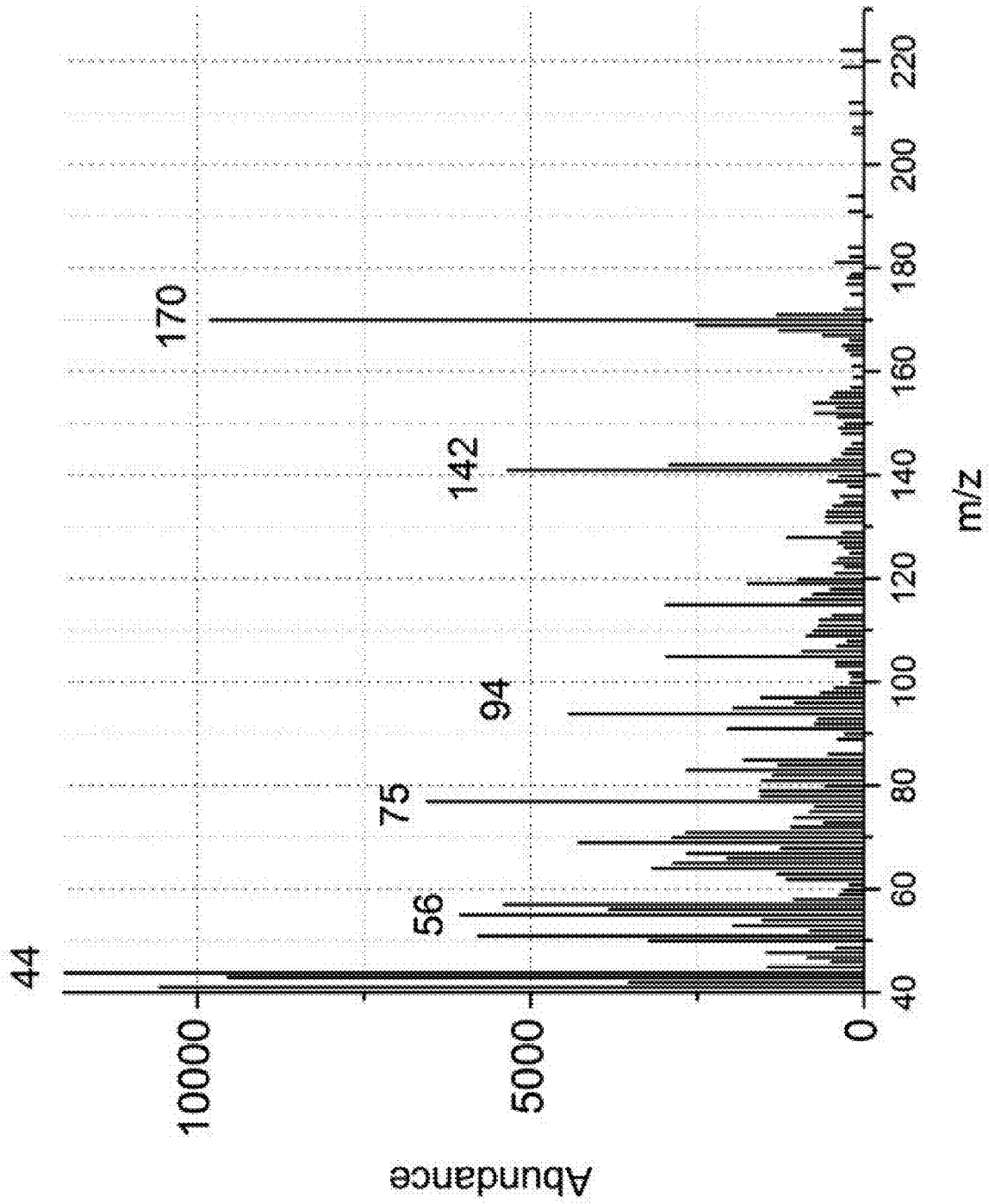
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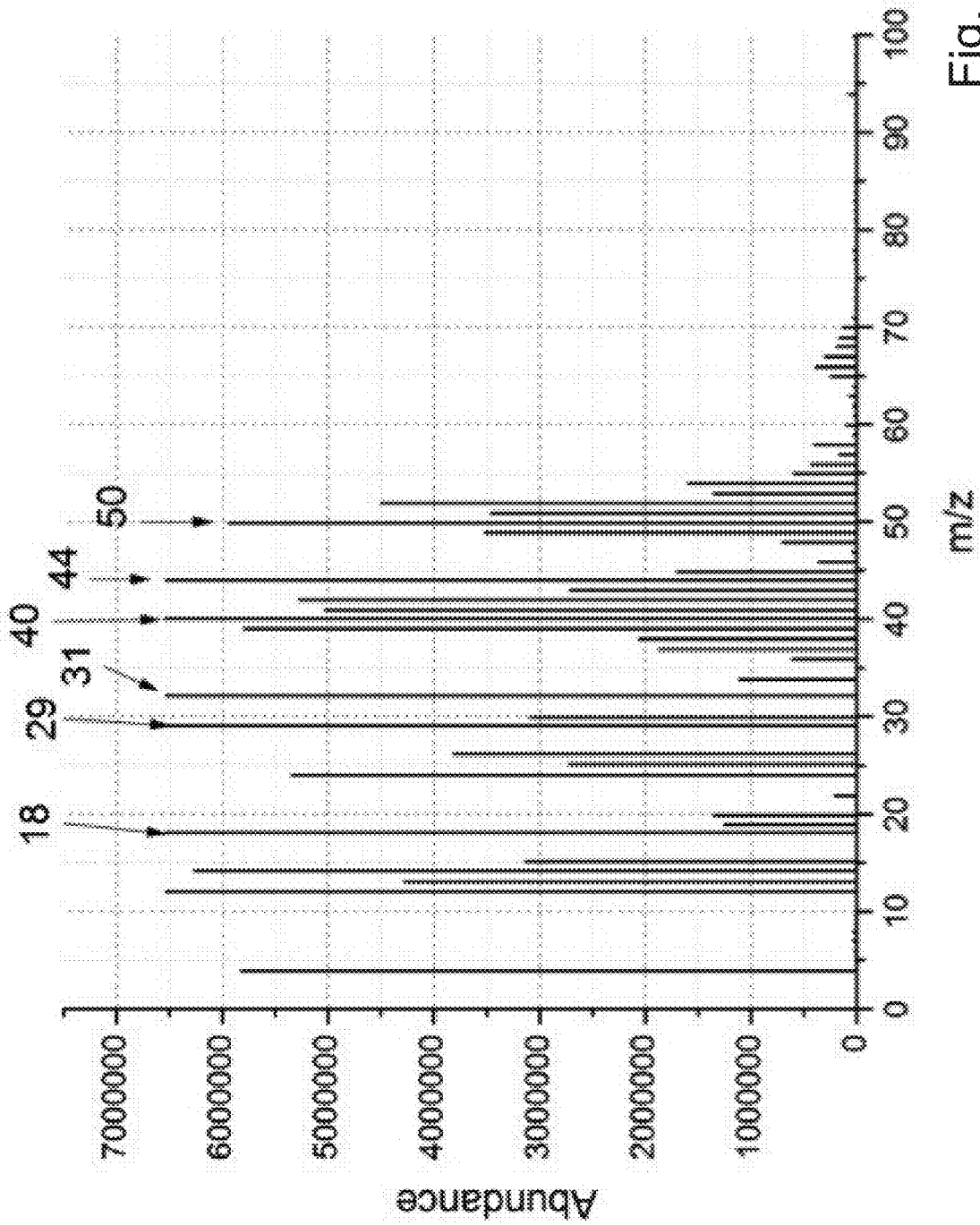
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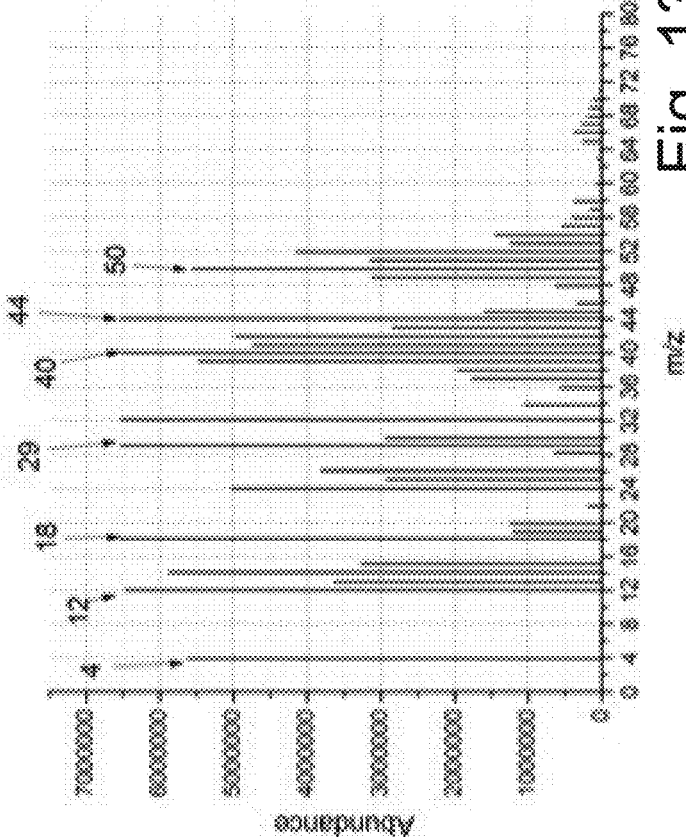
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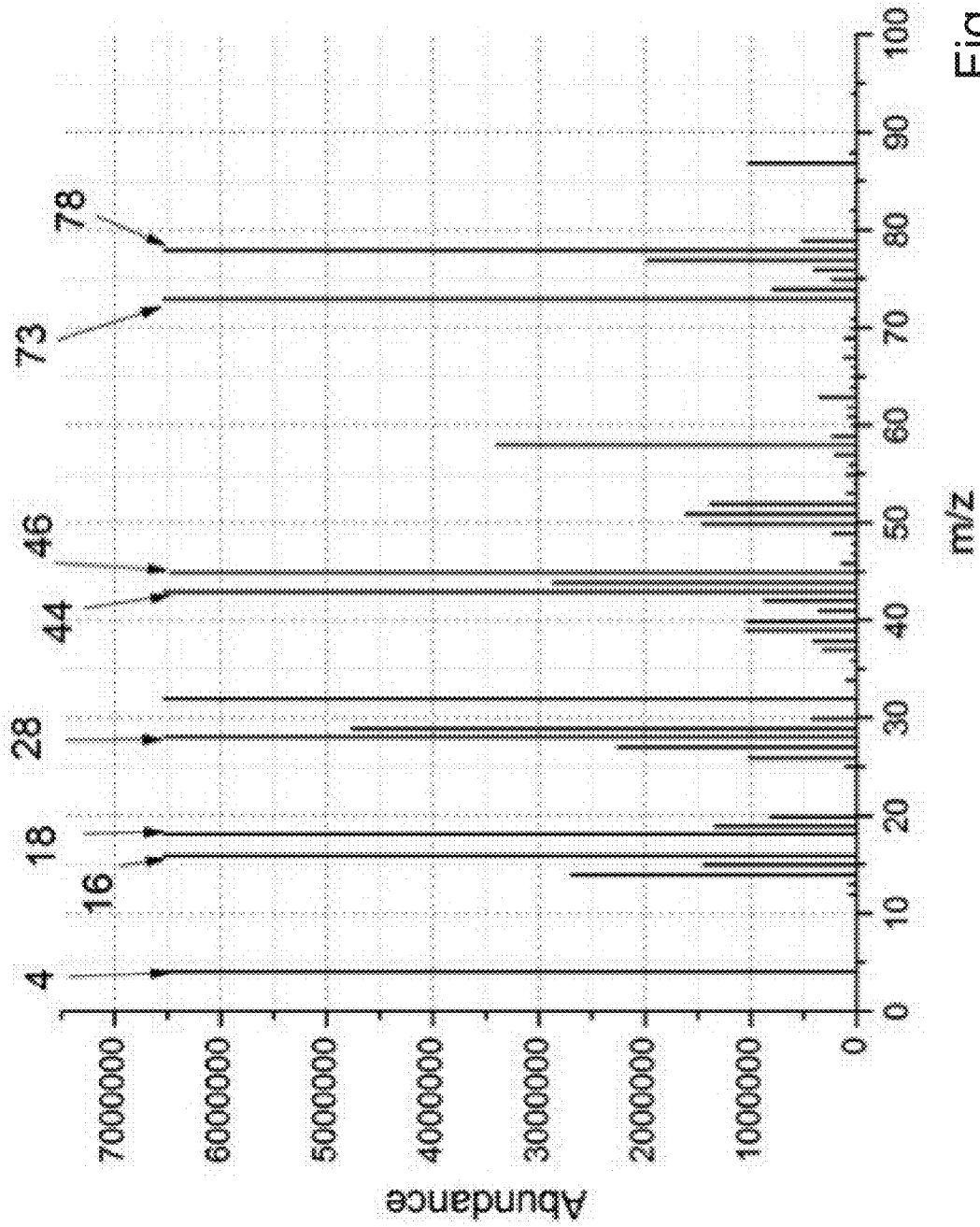
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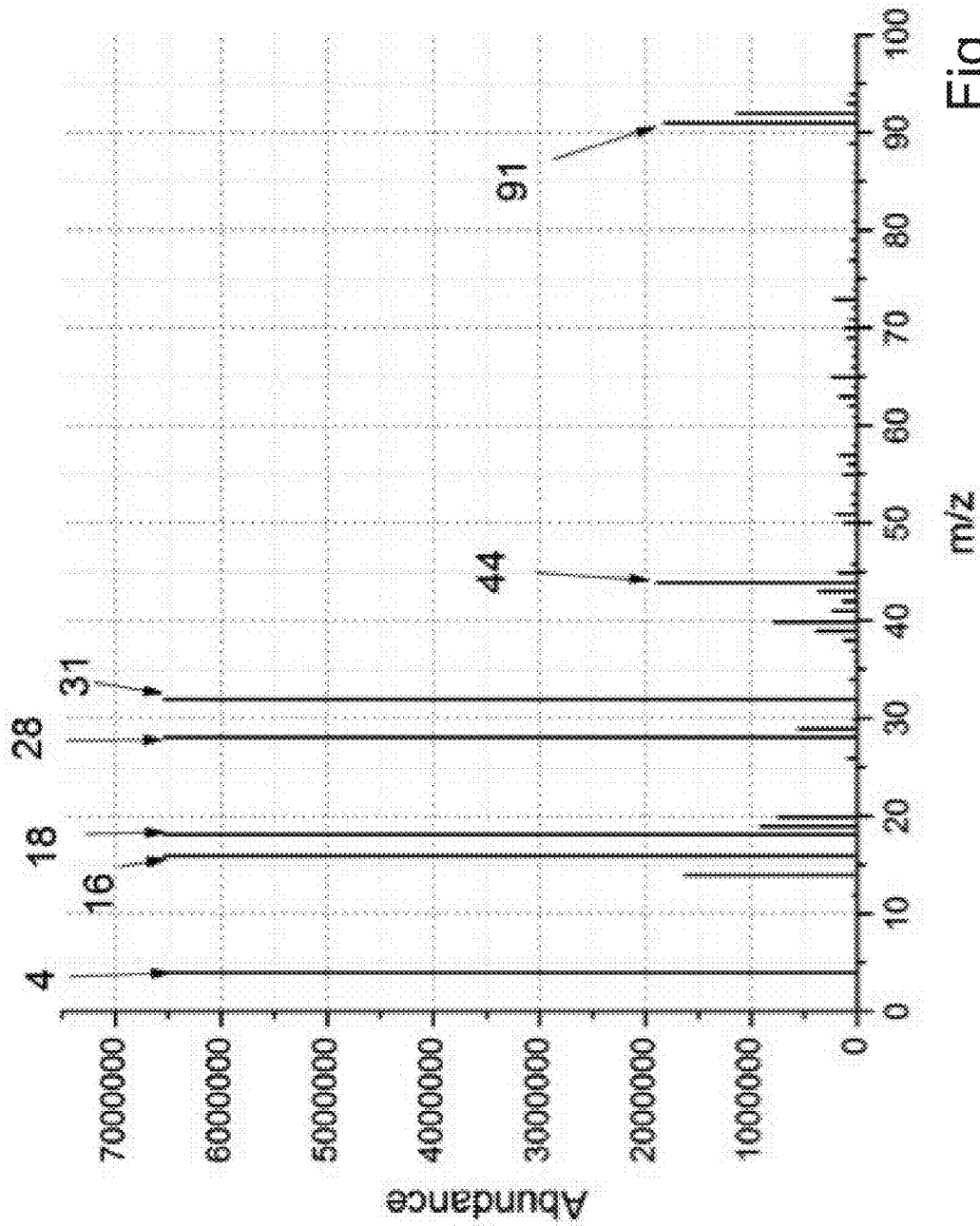
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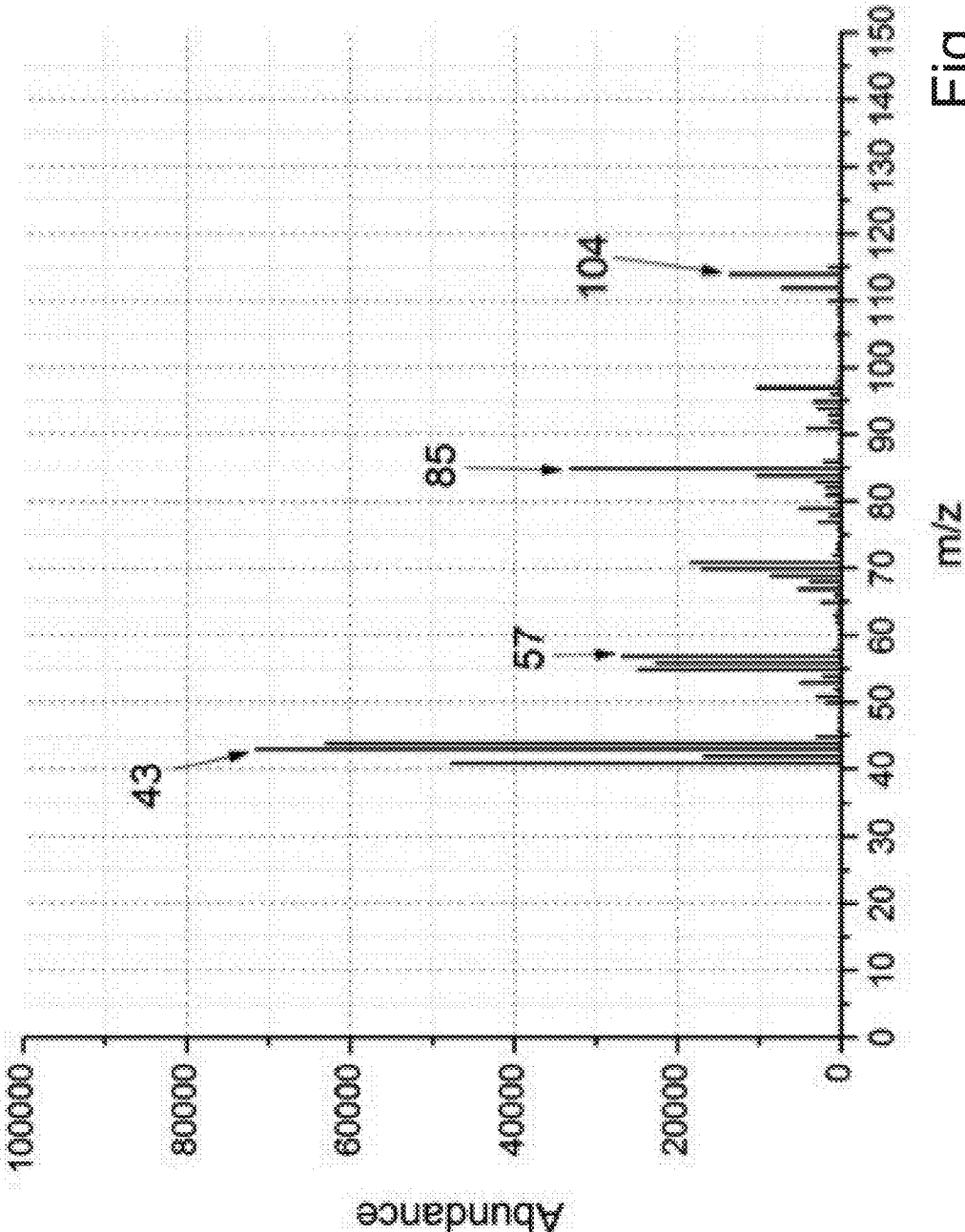
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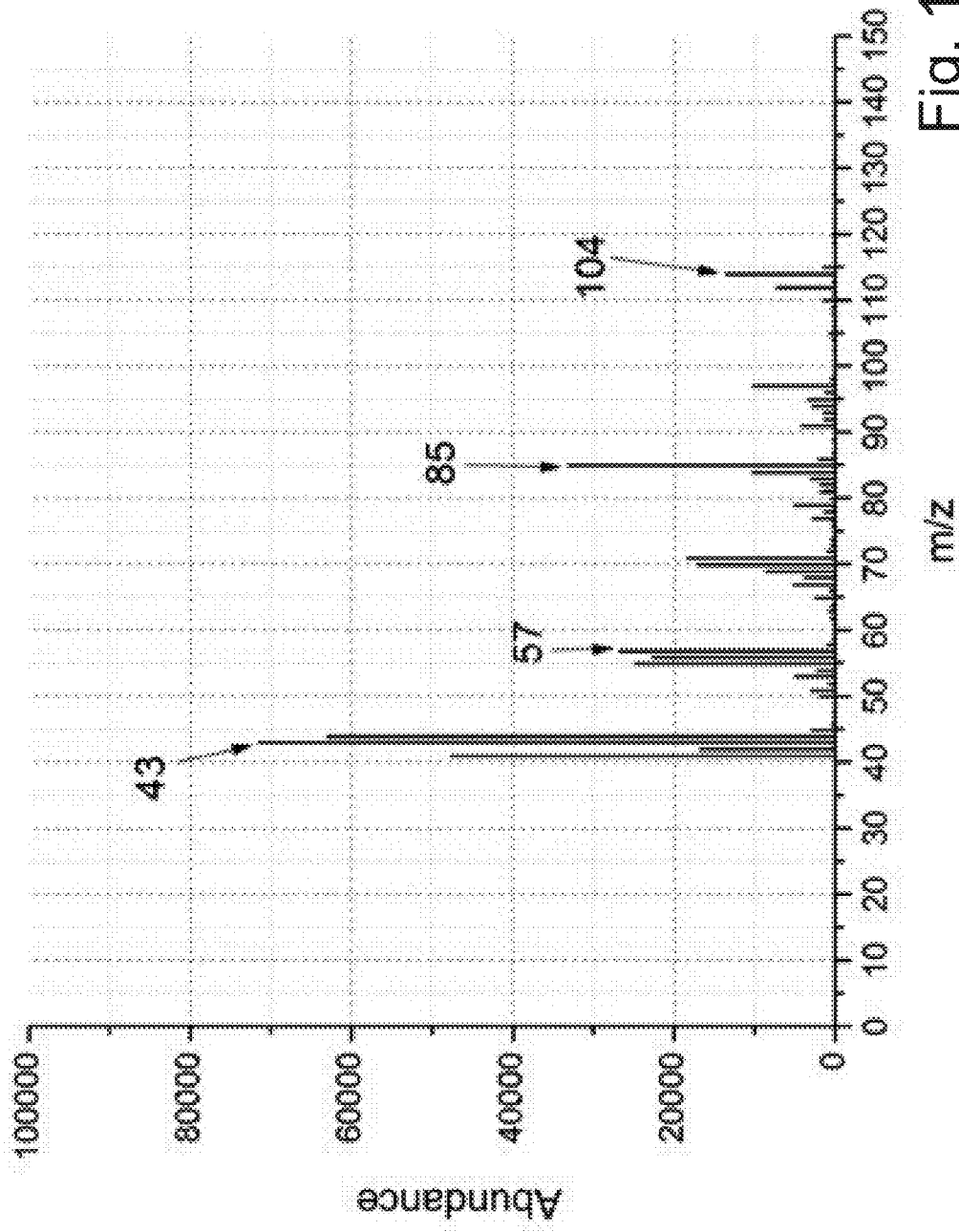
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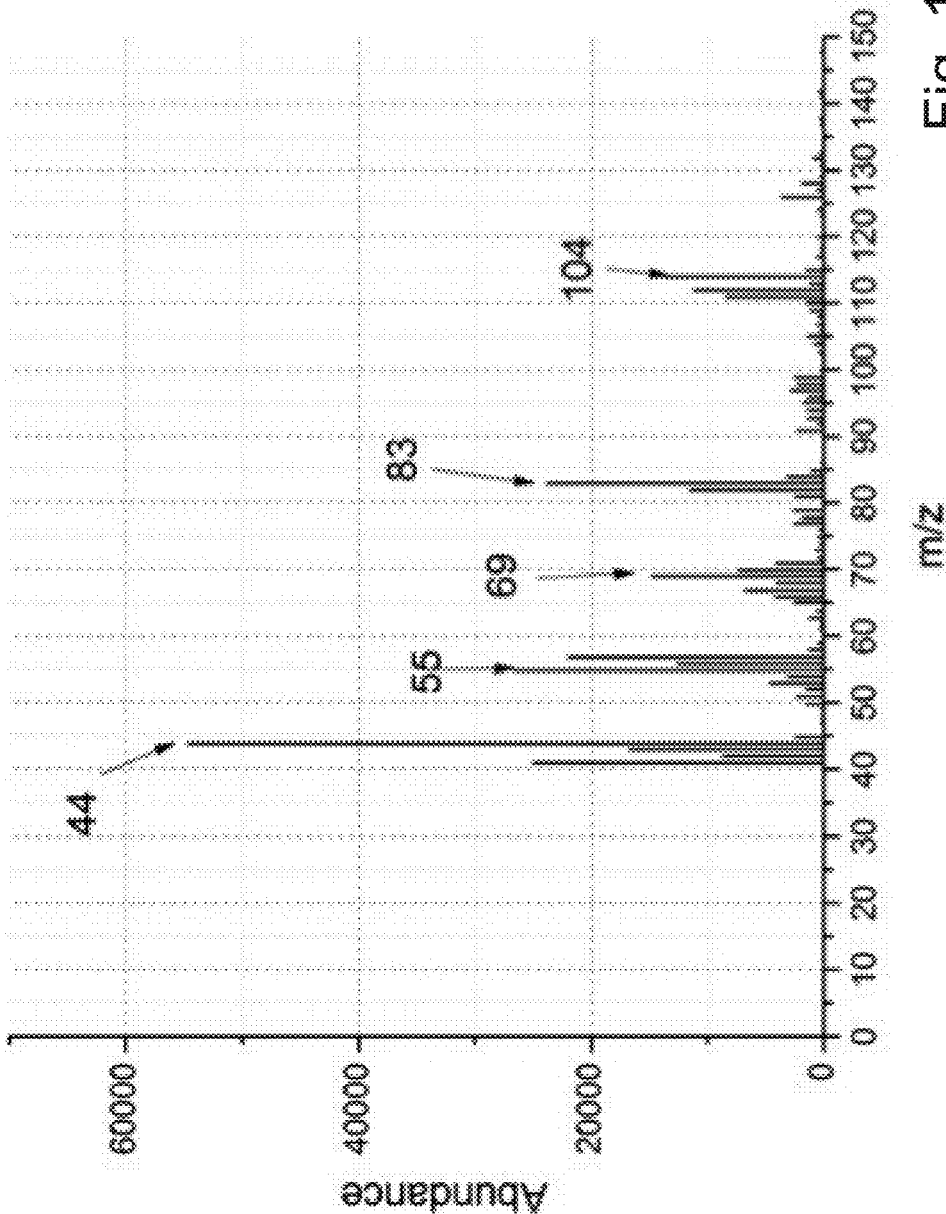
Fig. 16a

Fig. 16b

Fig. 17

Fig. 18

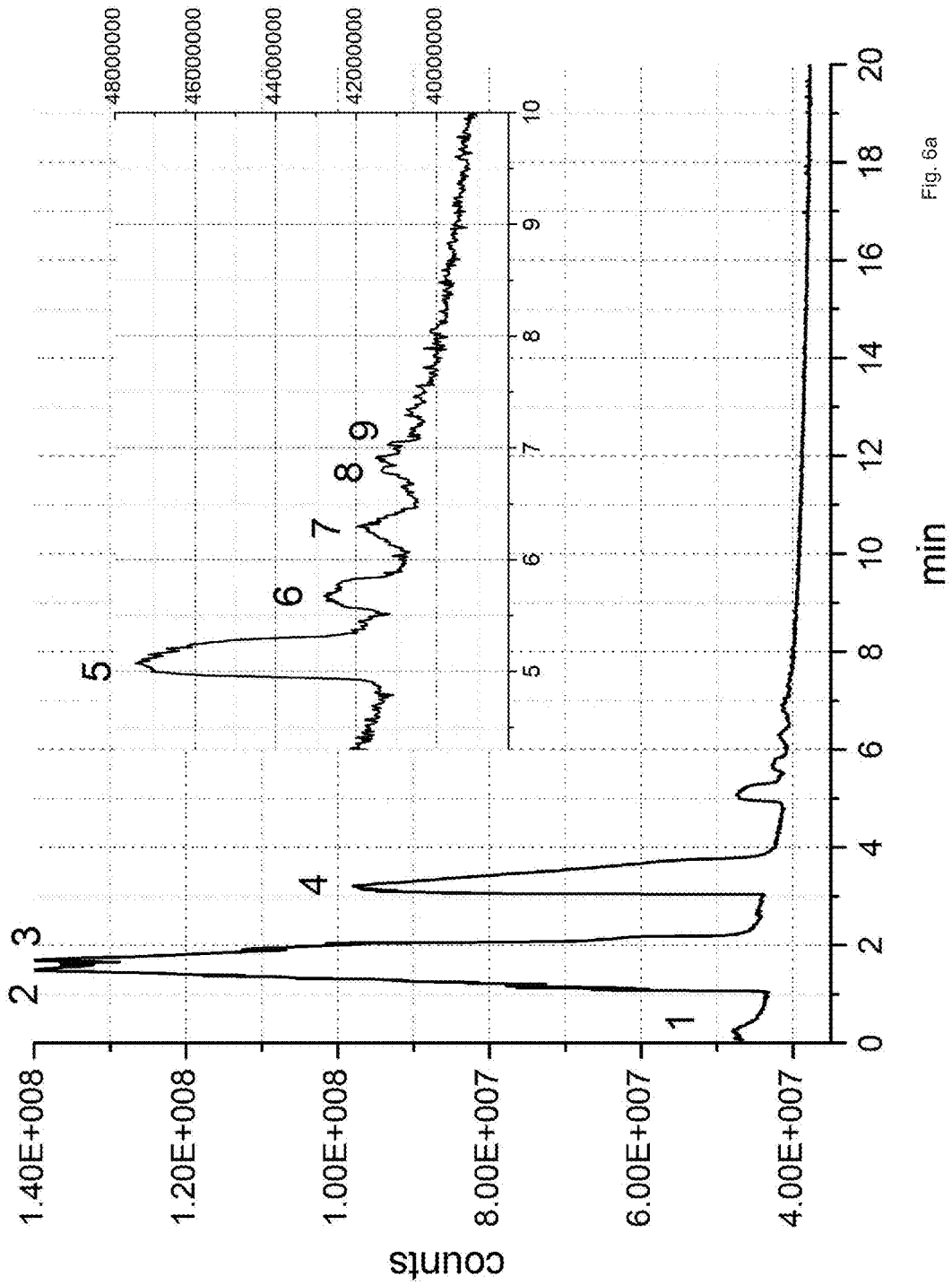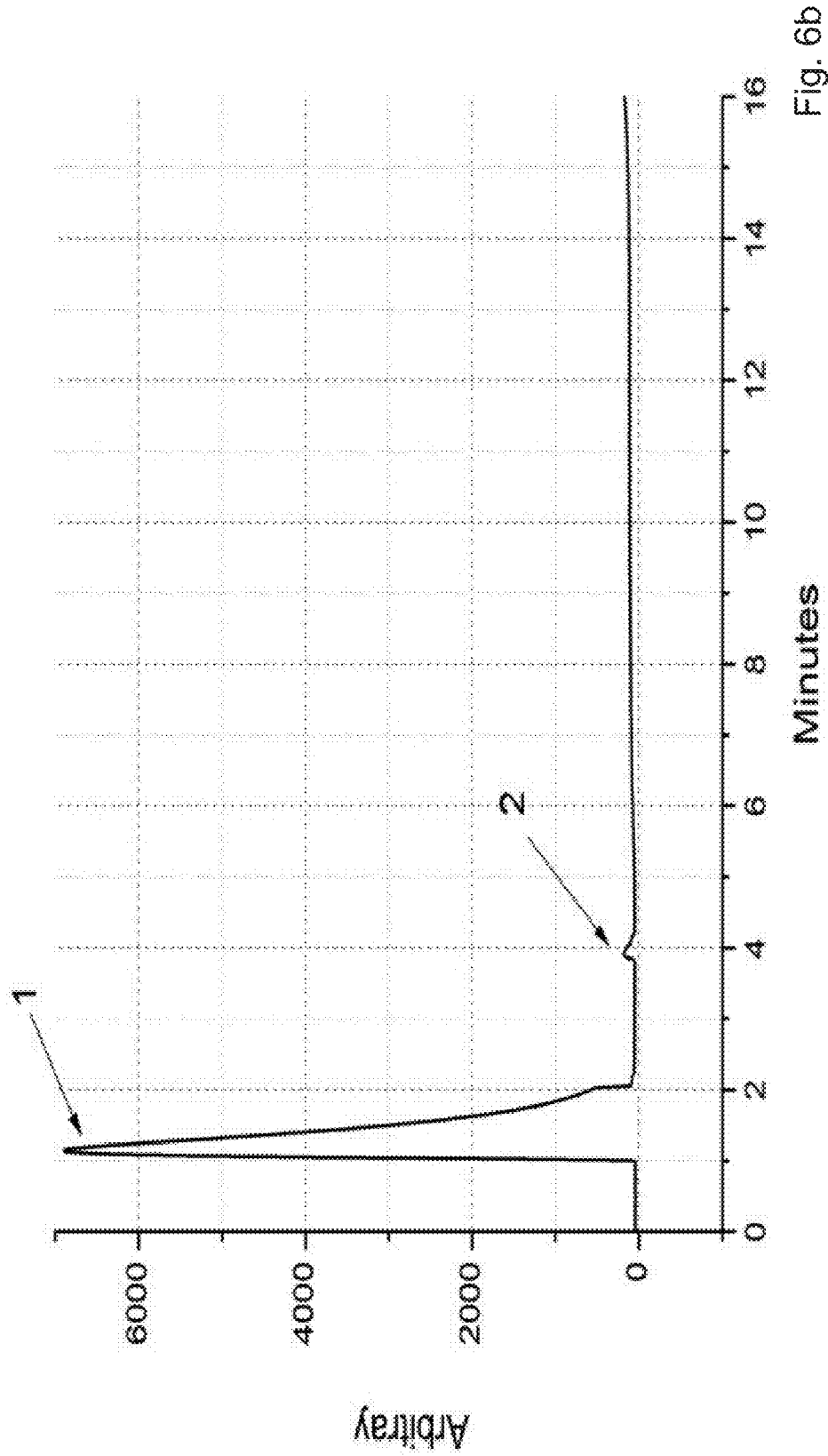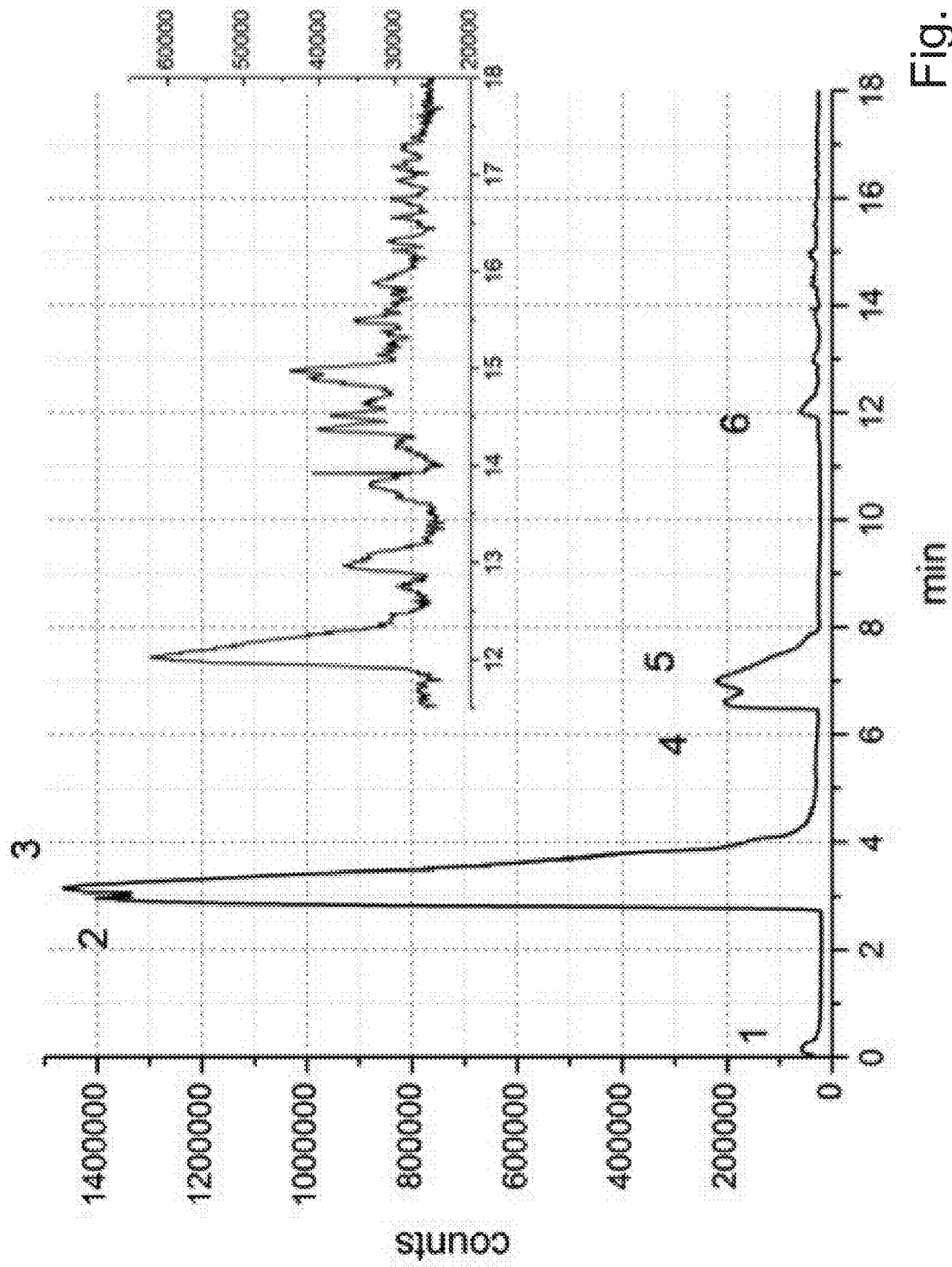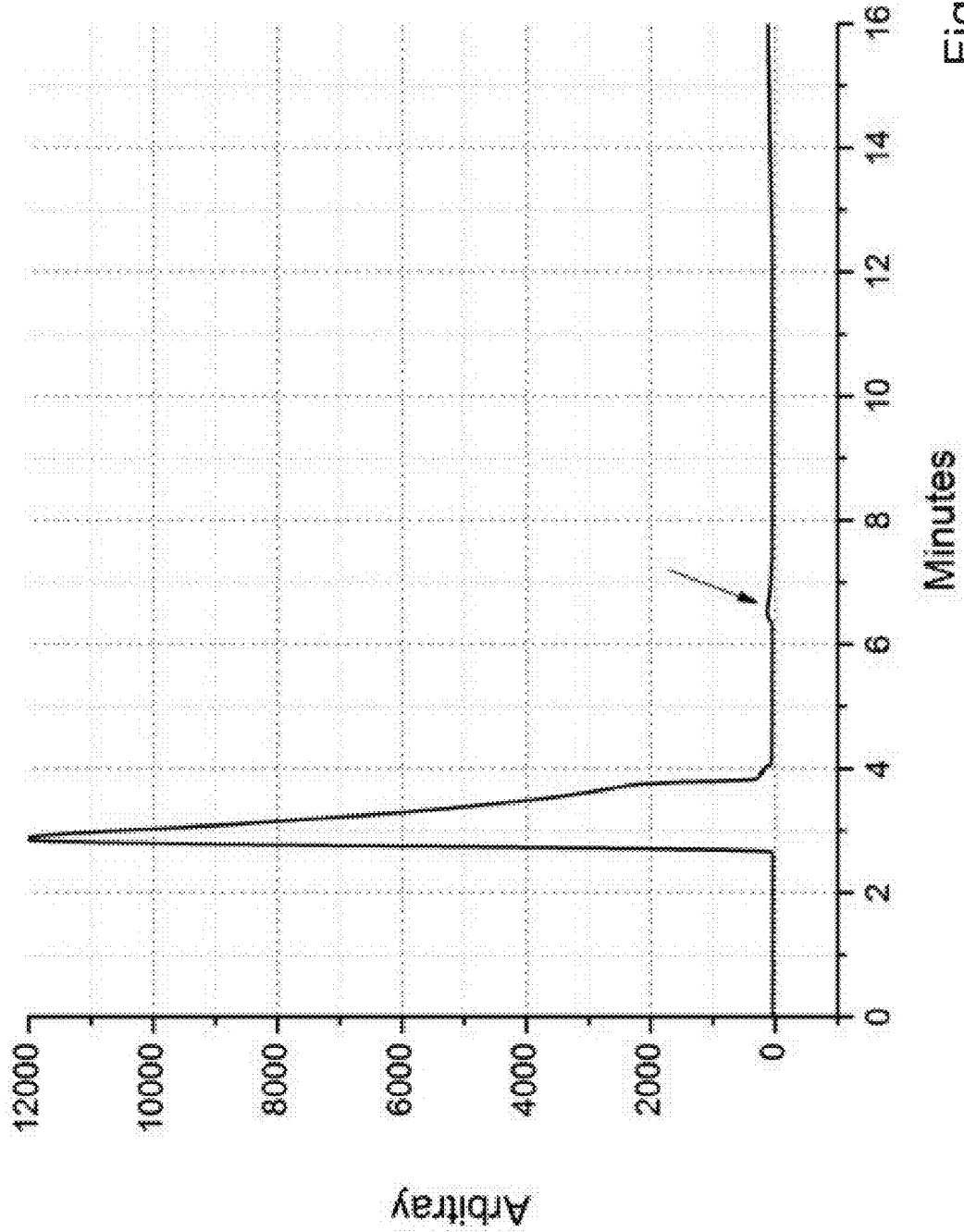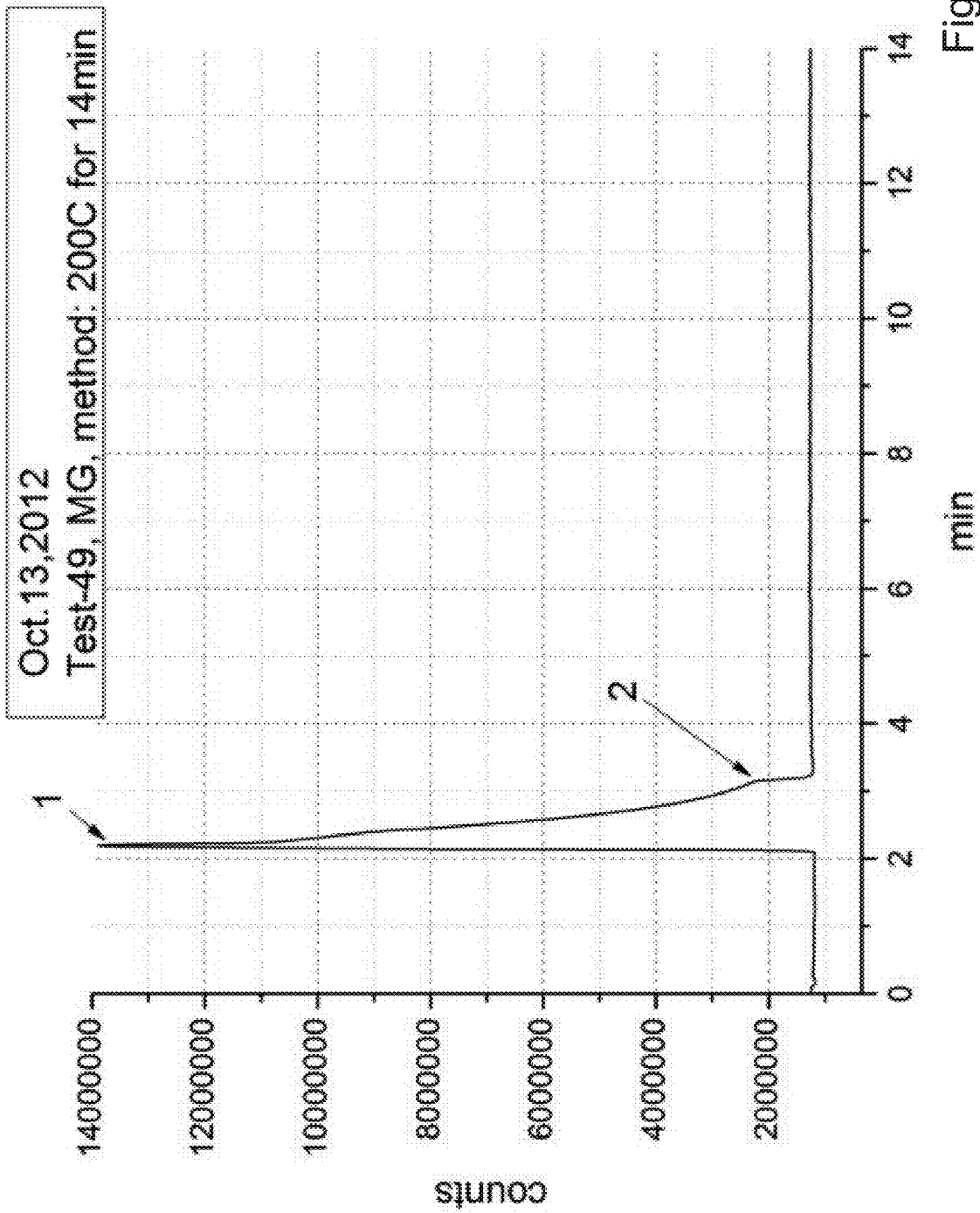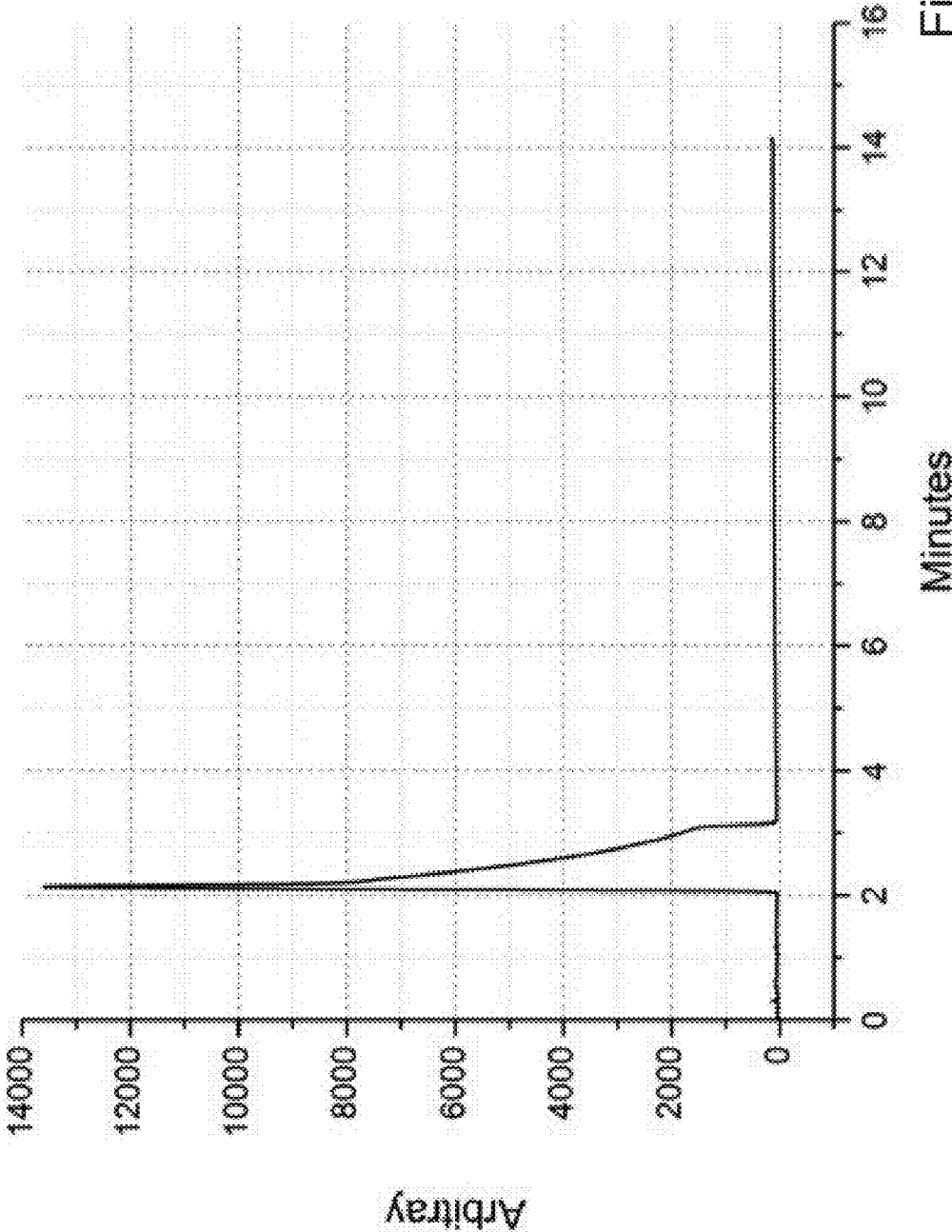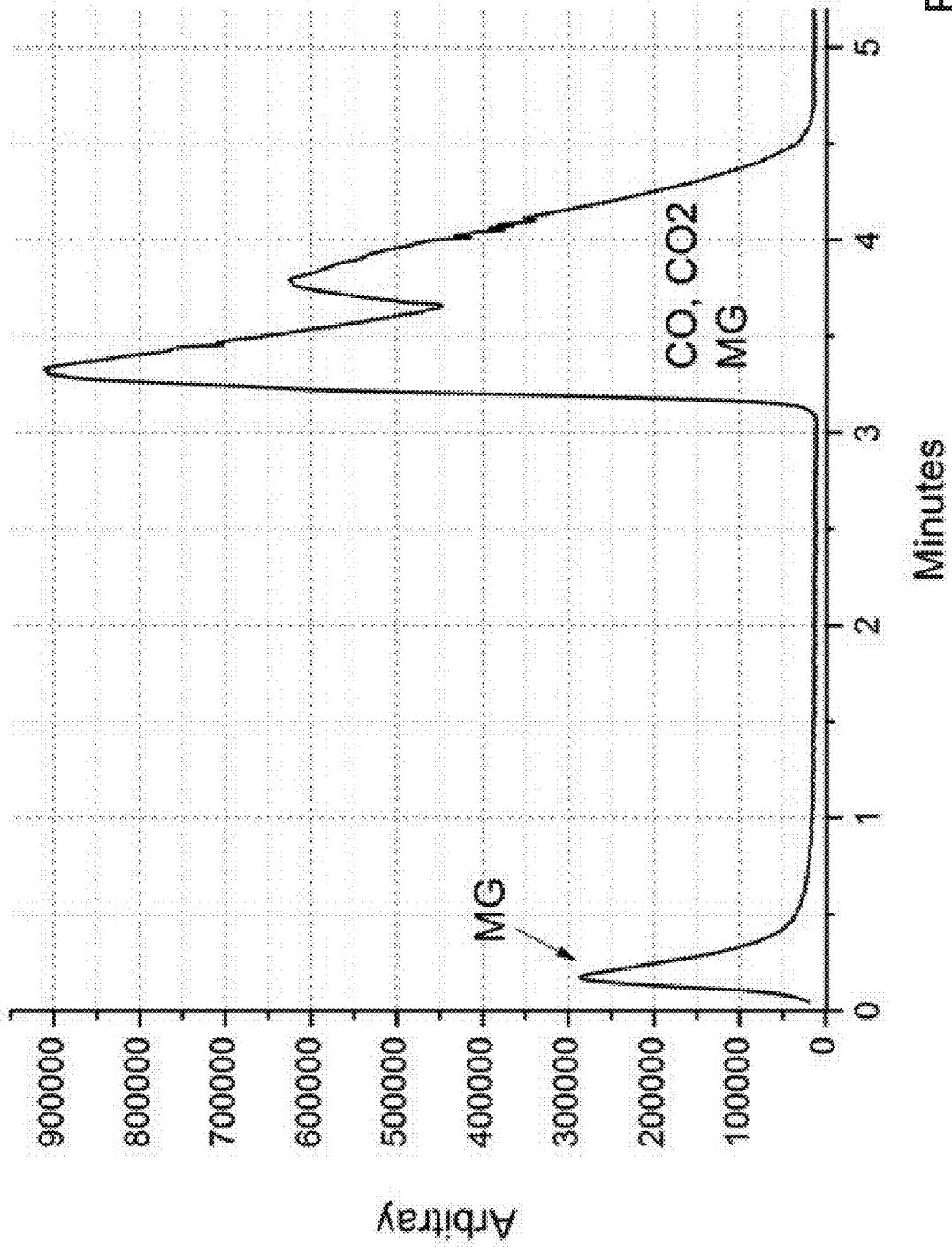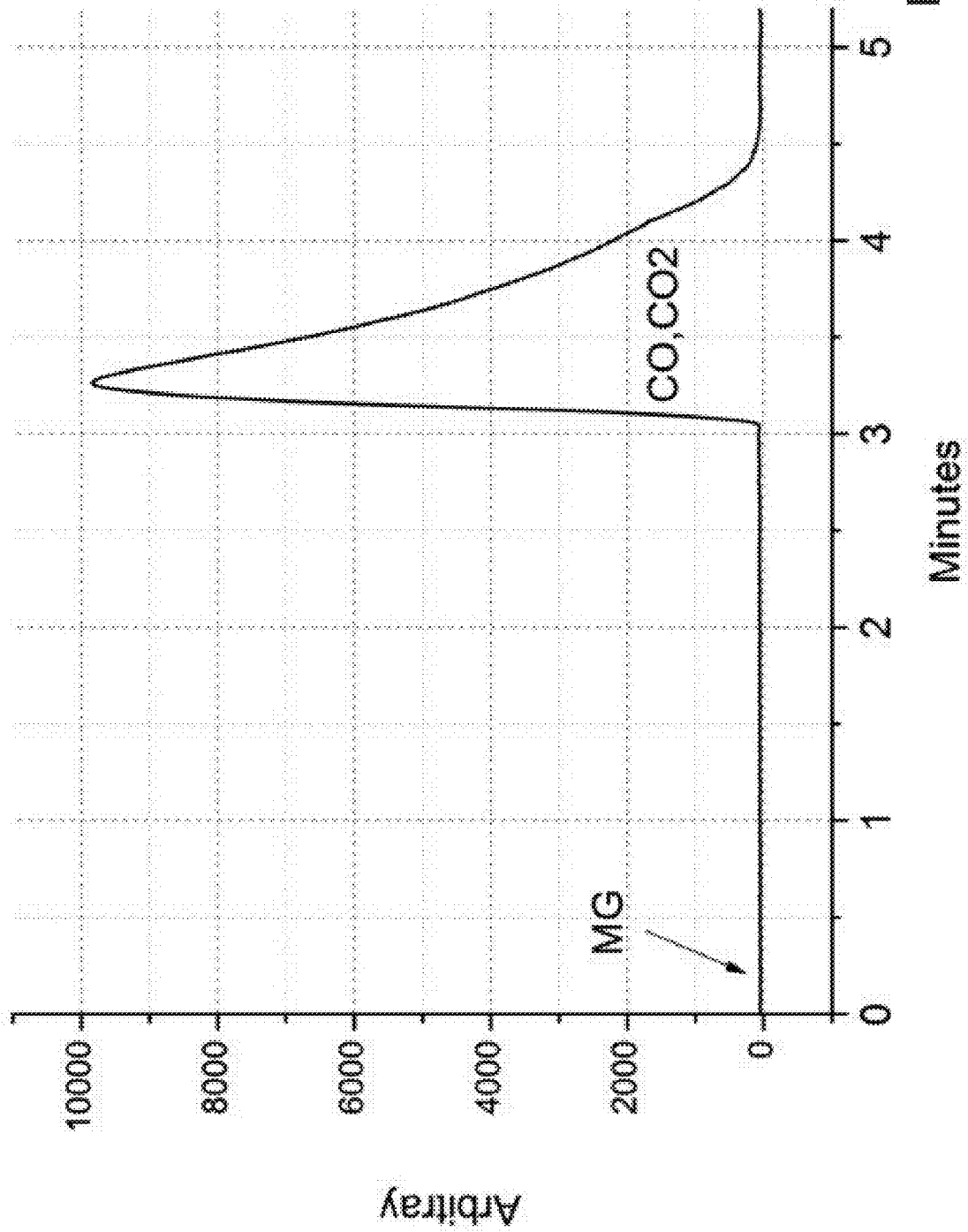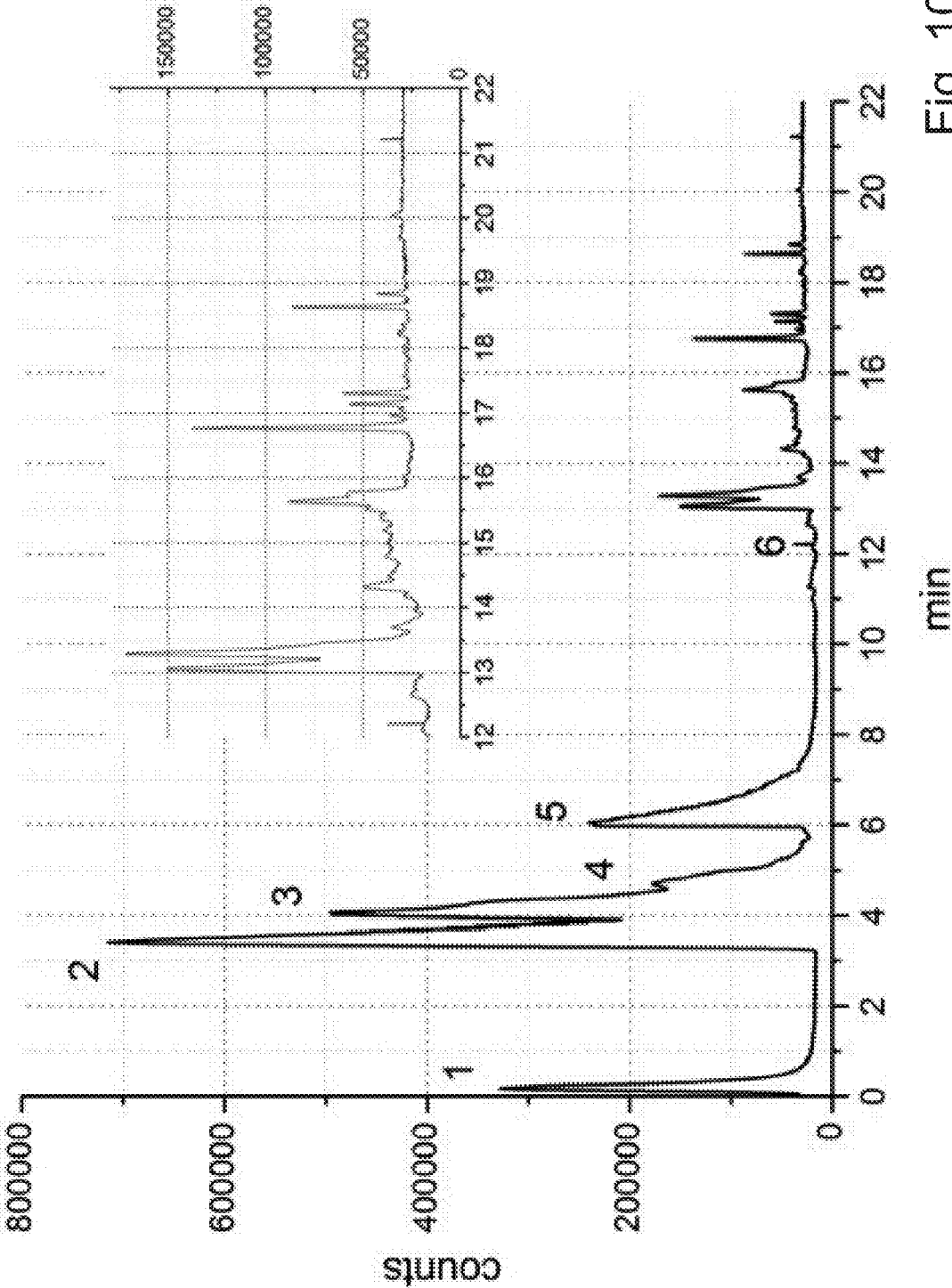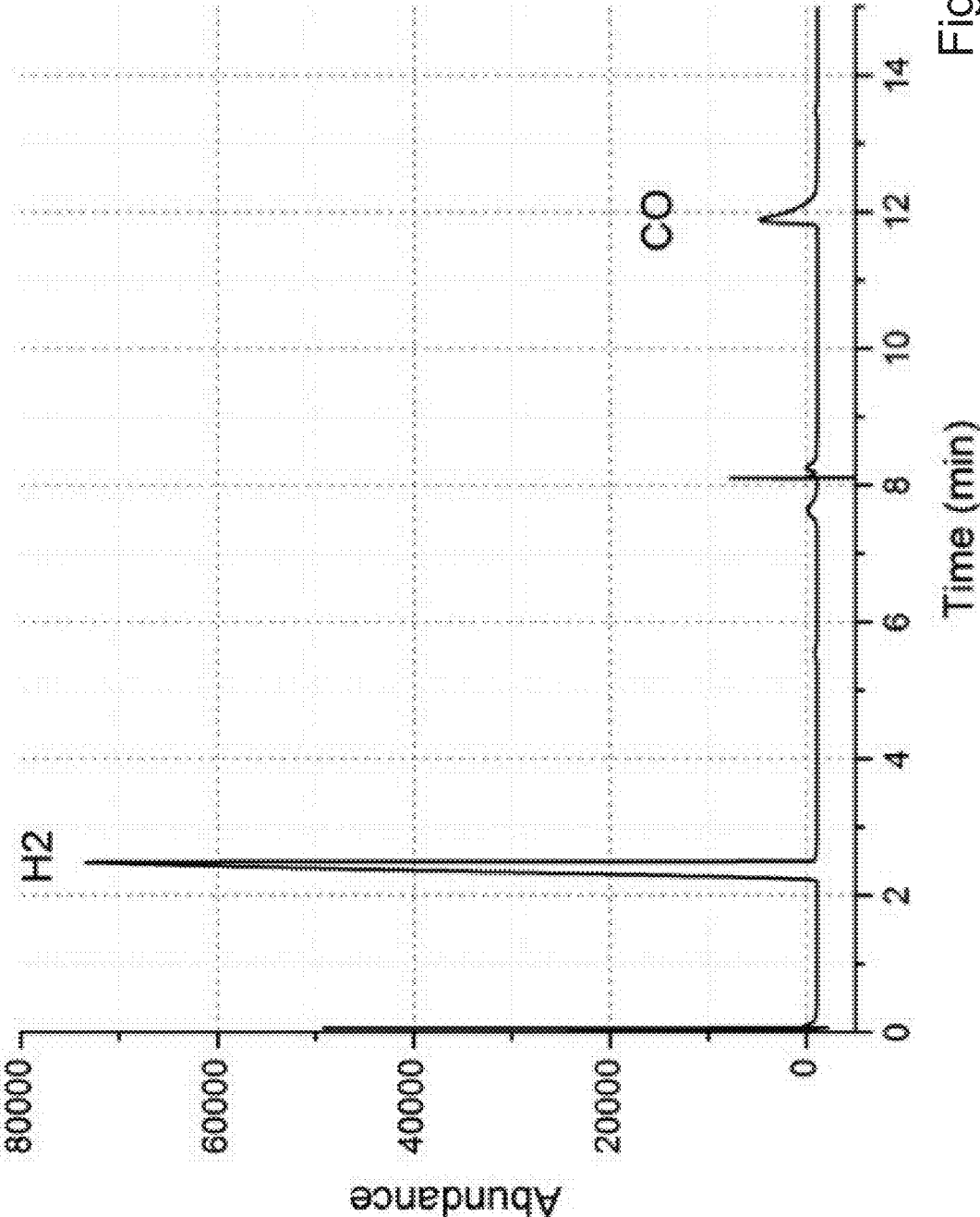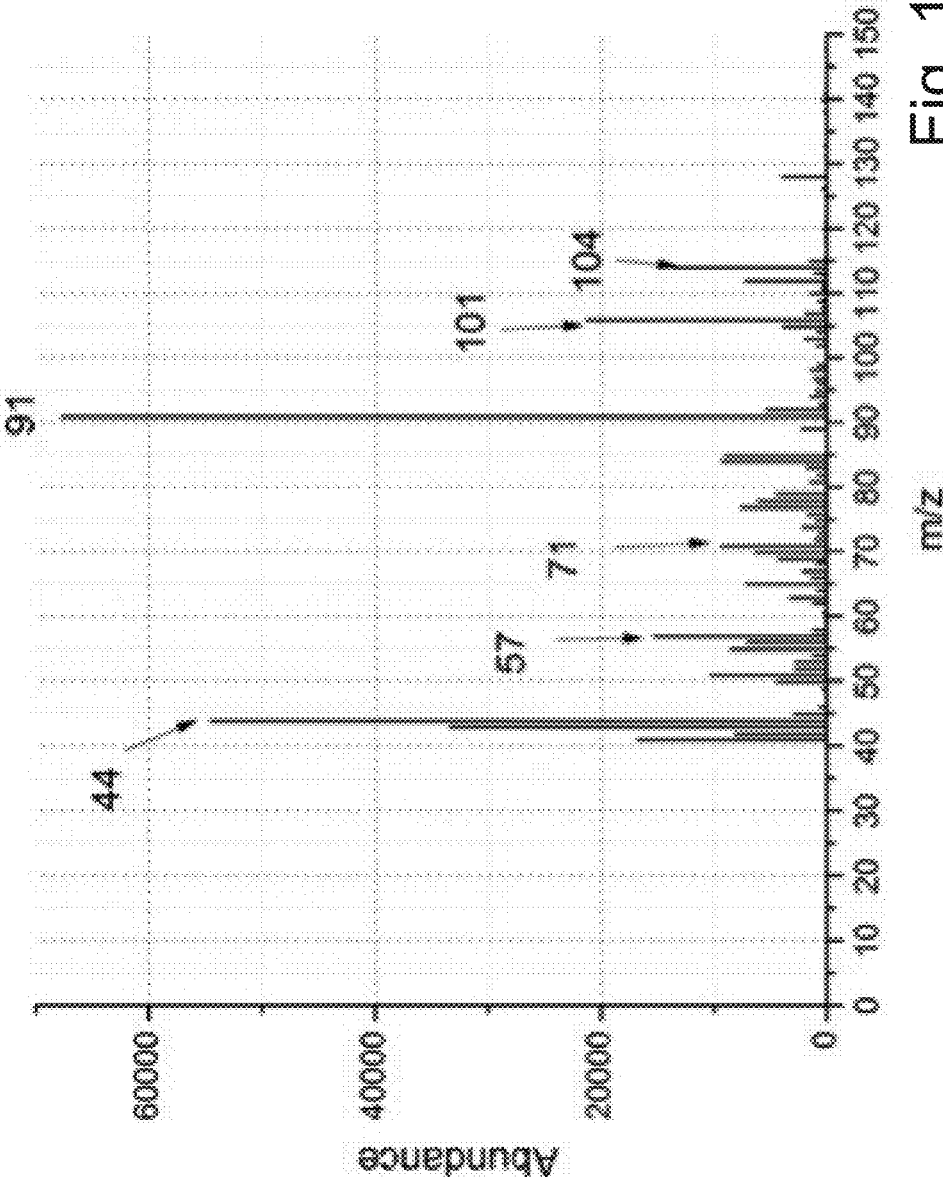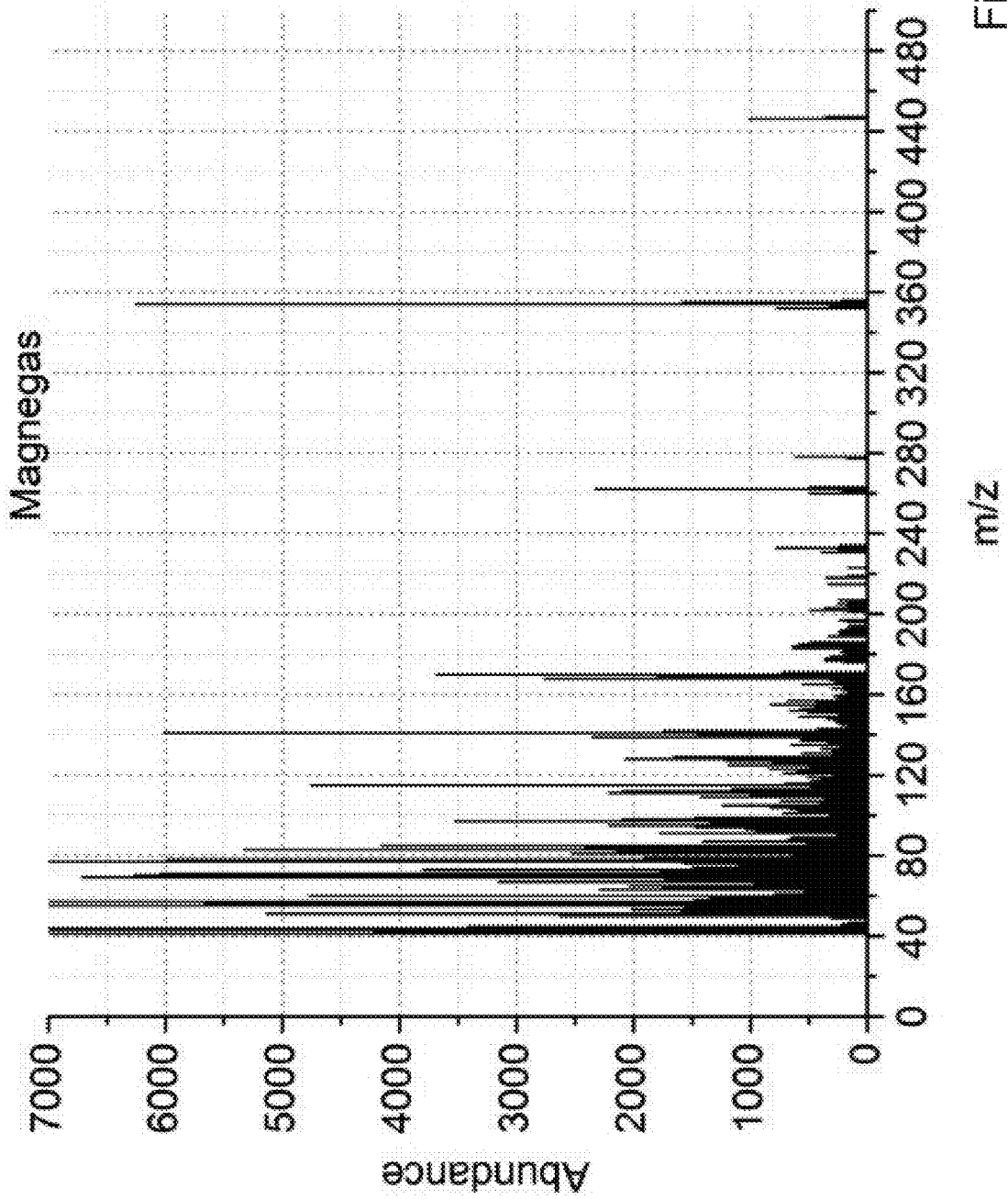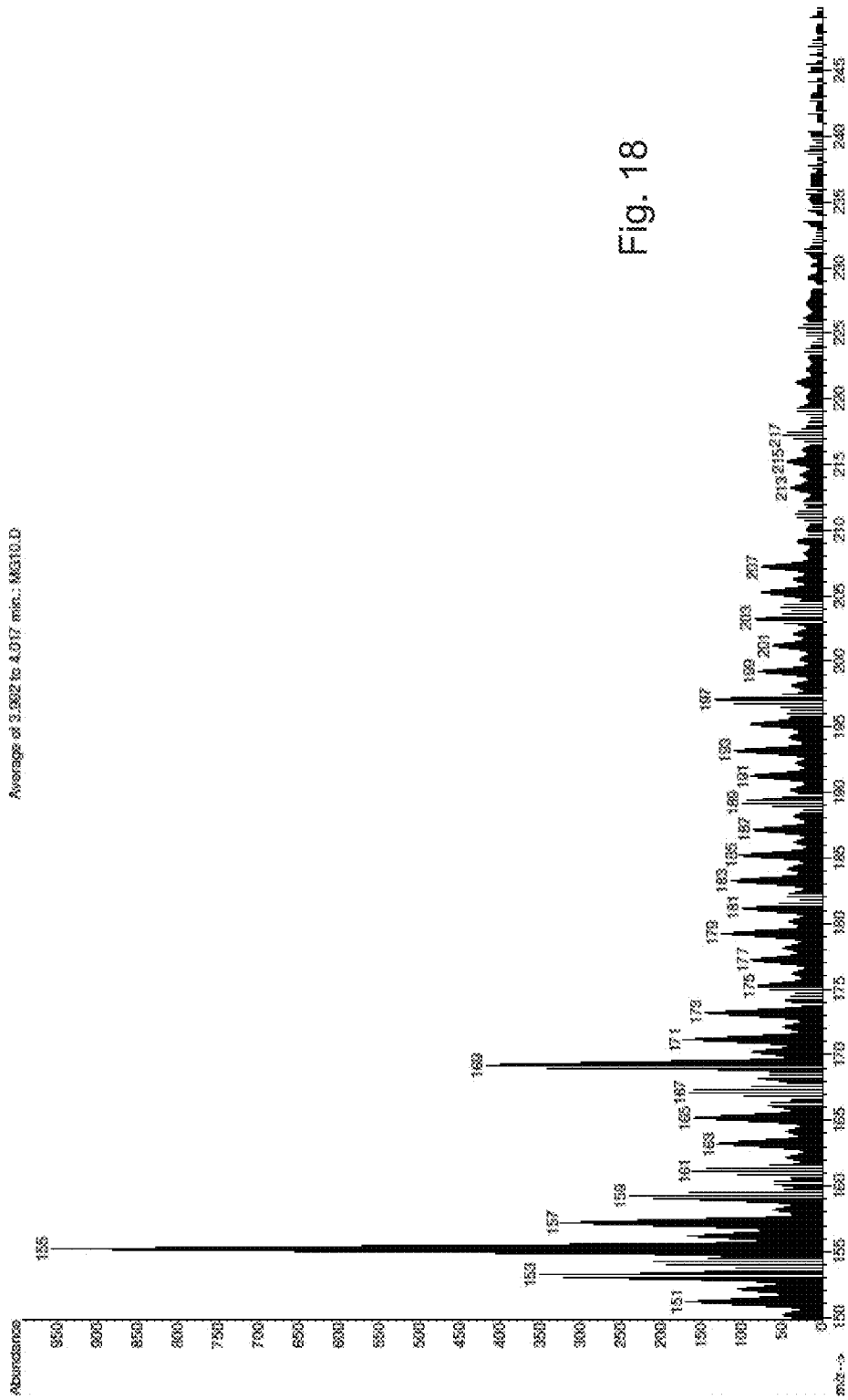|					
ORS REPORT NO.	185343-001		Fig. 19		
DATE TESTED	4/10/2010				
QUANTITY TESTED	7				
PACKAGE TYPE	standard				
SAMPLE	ID	A	B	1	2
Mass	2	1,531	3,343	288,163	185,549
Mass	3	0	236	49,815	438,891
Mass	4	0	203	12,648,080	12,342,540
Mass	5	0	0	332	933
Mass	6	0	0	13,260	12,020
Mass	7	1,507	1,185	0	0
Mass	8	380	0	0	0
Mass	11	160	122	0	0
Mass	12	619	158,821	4,850	9,025
Mass	13	0	1,781	449	400
Mass	14	887,617	745,201	57,902	11,191
Mass	15	3,525	2,392	1,875	1,578
Mass	16	286,293	259,183	24,627	16,952
Mass	17	14,875	15,487	2,269	12,165
Mass	18	50,806	52,423	10,248	104,140
Mass	19	53	11,475	3,242	8,594
Mass	20	12,301	11,149	8,302	71,458
Mass	21	0	0	0	729
Mass	22	0	19,942	222	159
Mass	23	0	61	0	0
Mass	24	0	0	182	218
Mass	25	0	0	633	240
Mass	26	220	180	2,838	1,408
Mass	27	0	0	873	878
Mass	28	8,188,280	7,056,760	536,530	125,200
Mass	29	57,521	49,468	4,334	2,548
Mass	30	10,389	8,393	3,618	5,306
Mass	31	0	101	178	1,601
Mass	32	1,880,953	96,766	118,498	13,475
Mass	33	1,339	0	139	483
Mass	34	7,608	365	577	1,449
Mass	35	0	0	0	225
Mass	36	409	313	0	1,848
Mass	37	0	0	0	79
Mass	38	123	61	0	119
Mass	39	301	0	308	433
Mass	40	97,549	80,615	5,857	563
Mass	41	463	81	209	328
Mass	42	225	0	197	317
Mass	43	480	0	113	295
Mass	44	5,795	1,806,671	14,262	13,828
Mass	45	166	20,644	199	265
Mass	46	60	7,265	98	159
Mass	47	0	109	0	0
Mass	48	0	0	0	0
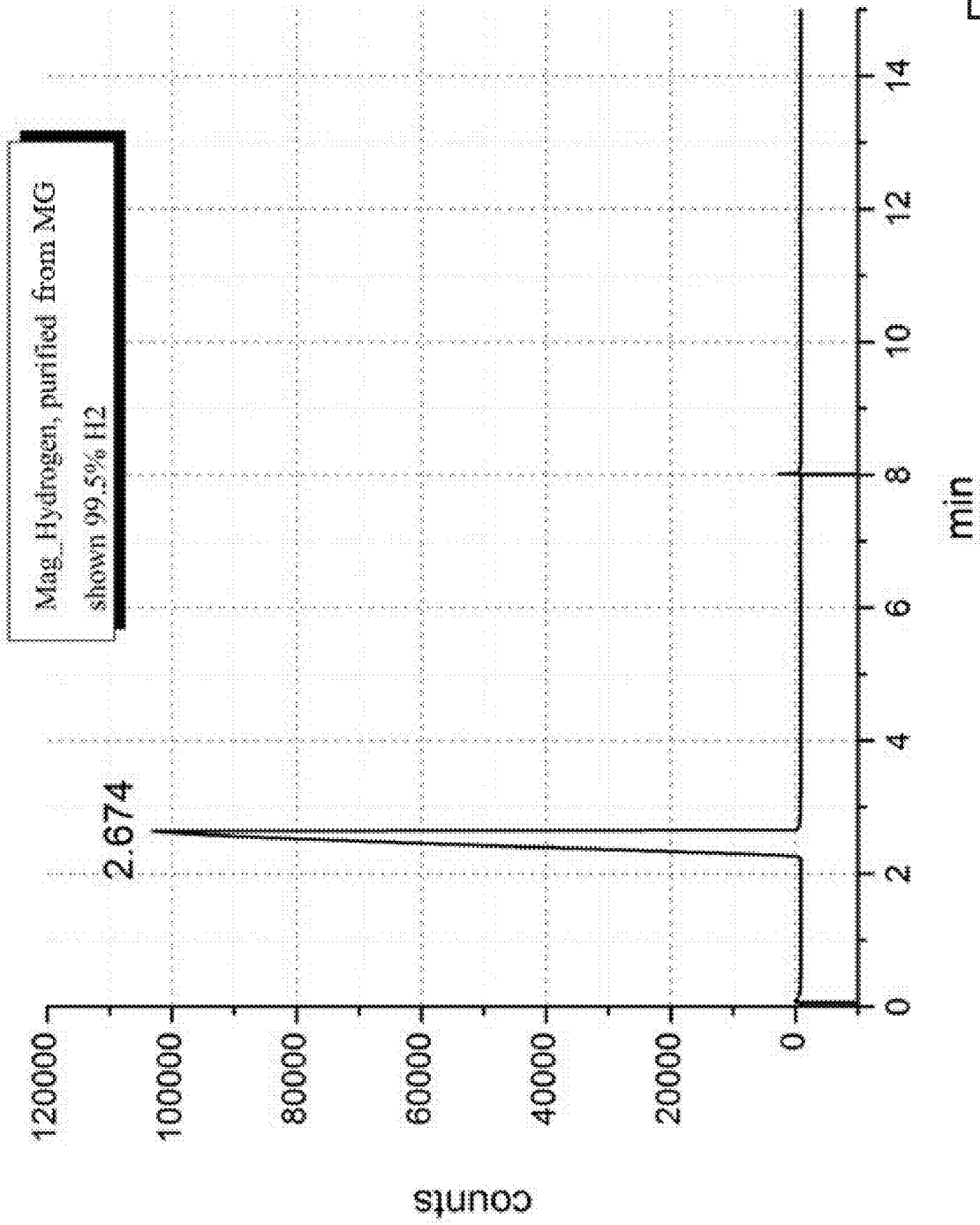
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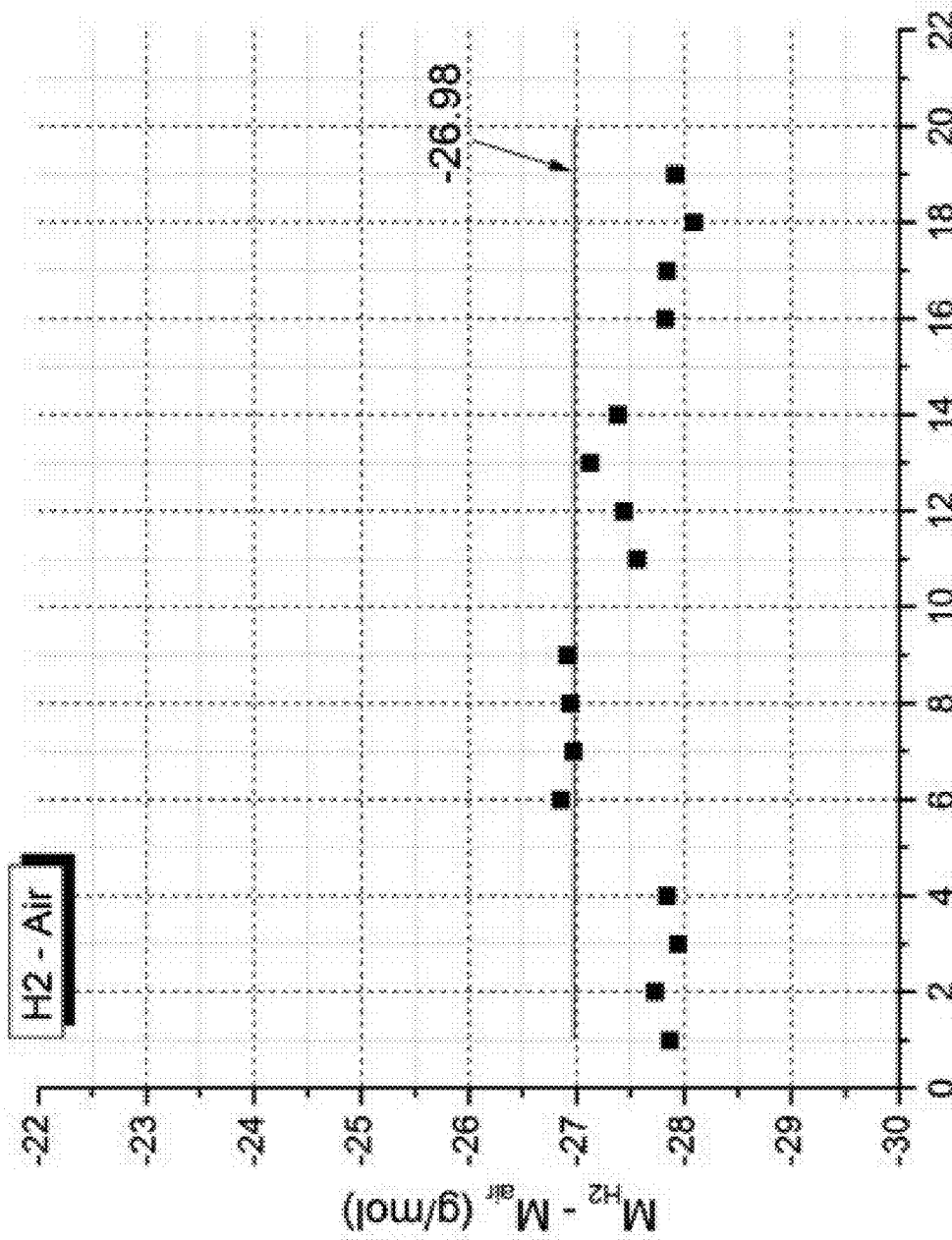
Fig. 21a

Fig. 21b

	H2	air
15 psi	-0.3018	-27.8709
	-0.3003	-27.7323
	-0.3026	-27.9447
	-0.3015	-27.8432
10 psi	-0.2439	-26.8554
	-0.245	-26.9765
	-0.2447	-26.9435
	-0.2445	-26.9215

	H2	air
5 psi	-0.2022	-27.5648
	-0.2013	-27.4421
	-0.199	-27.1286
	-0.2009	-27.3876
0 psi	-0.1458	-27.8265
	-0.1459	-27.8456
	-0.1472	-28.0937

Fig. 22a

15 psi	He	air
	-0.2776	-25.636
	-0.278	-25.673
	-0.2773	-25.6083
	-0.2776	-25.636

10 psi	He	air
	-0.2241	-24.6752
	-0.2263	-24.9175
	-0.225	-24.7743
	-0.2251	-24.7854

5 psi	He	air
	-0.1871	-25.5063
	-0.1868	-25.4654
	-0.1865	-25.4245
	-0.1868	-25.4654
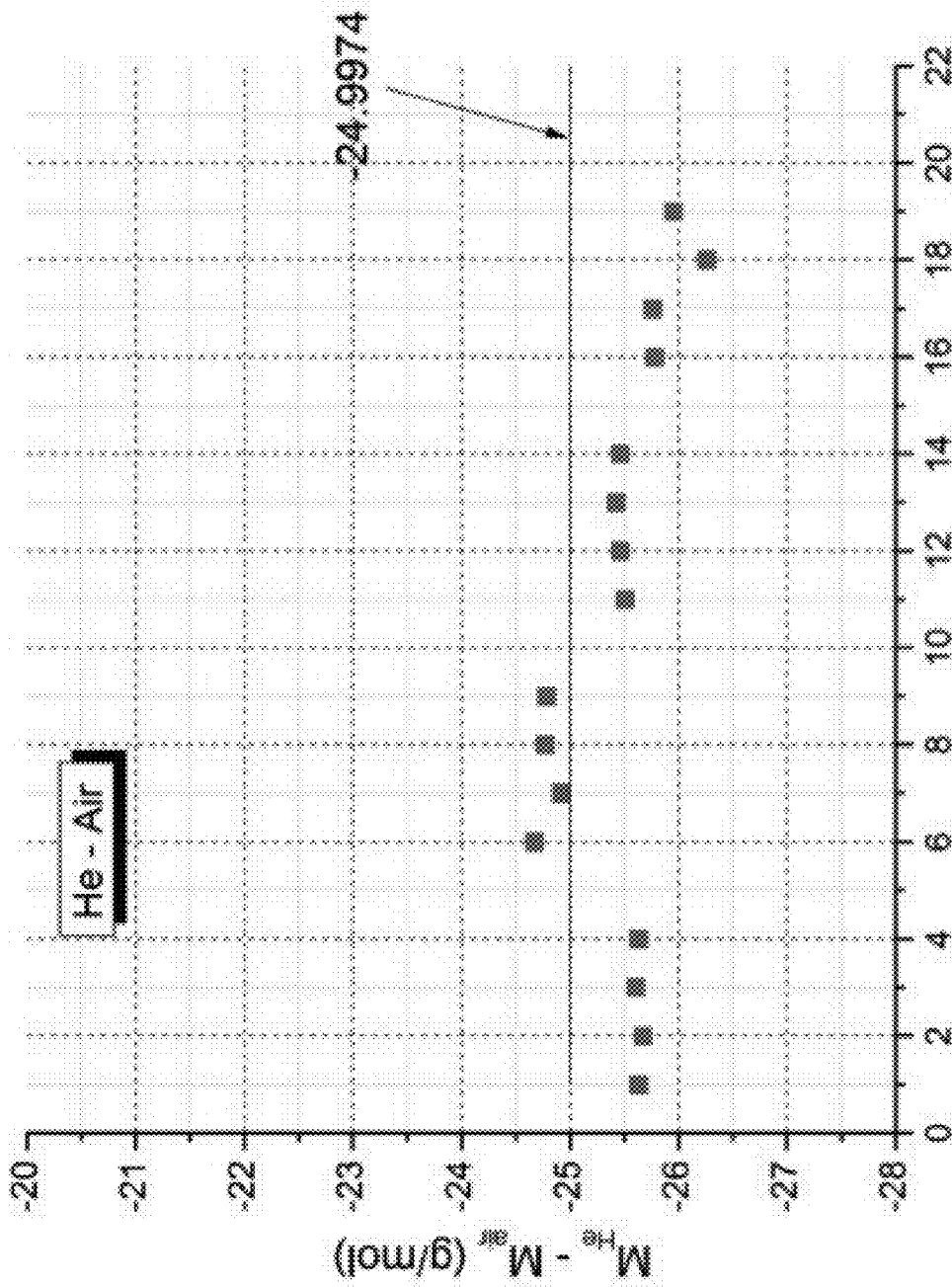
0 psi	He	air
	-0.1351	-25.7844
	-0.135	-25.7653
	-0.1376	-26.2615
	-0.136	-25.9562

Fig. 22b

Fig. 23

ORS REPORT NO.	196809-001		
DATE TESTED	9/5/2012		
QUANTITY TESTED	2		
PACKAGE TYPE	standard		
SAMPLE	ID	EQ09012	EQ02171
Mass	2	177,131	150,391
Mass	3	93,300	77,390
Mass	4	354,930	397,630
Mass	5	373	242
Mass	6	20,779	16,402
Mass	12	1,208	753
Mass	13	73	70
Mass	14	4,517	3,051
Mass	15	641	518
Mass	16	4,393	2,411
Mass	17	9,362	3,121
Mass	18	39,386	12,362
Mass	19	5,922	2,123
Mass	20	17,950	4,954
Mass	22	178	0
Mass	24	239	0
Mass	26	1,043	236
Mass	27	466	320
Mass	28	43,690	28,234
Mass	29	1,186	881
Mass	30	1,305	382
Mass	31	228	0
Mass	32	7,328	5,828
Mass	40	469	337
Mass	42	137	0
Mass	43	459	456
Mass	44	11,546	8,718
Mass	45	399	375
Mass	46	137	0
Mass	73	320	336

Fig. 24
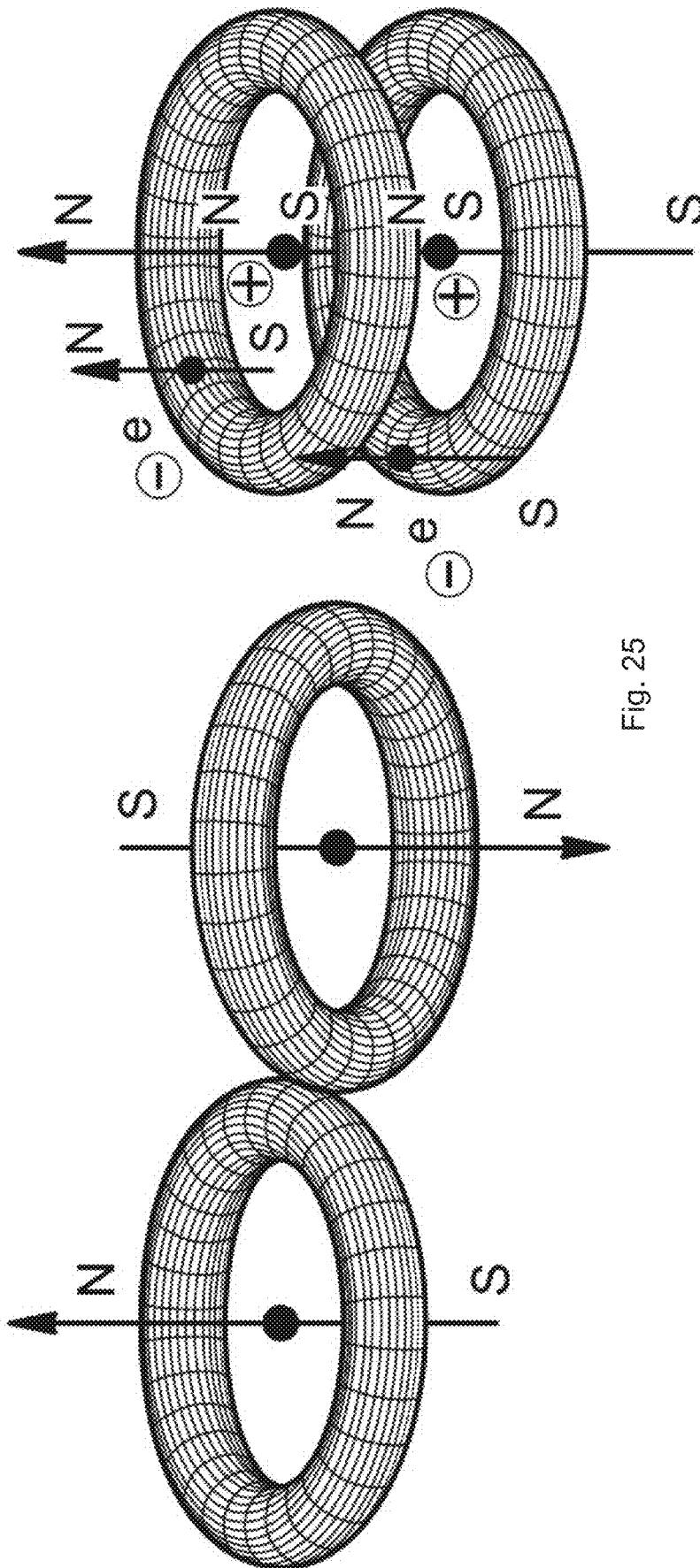
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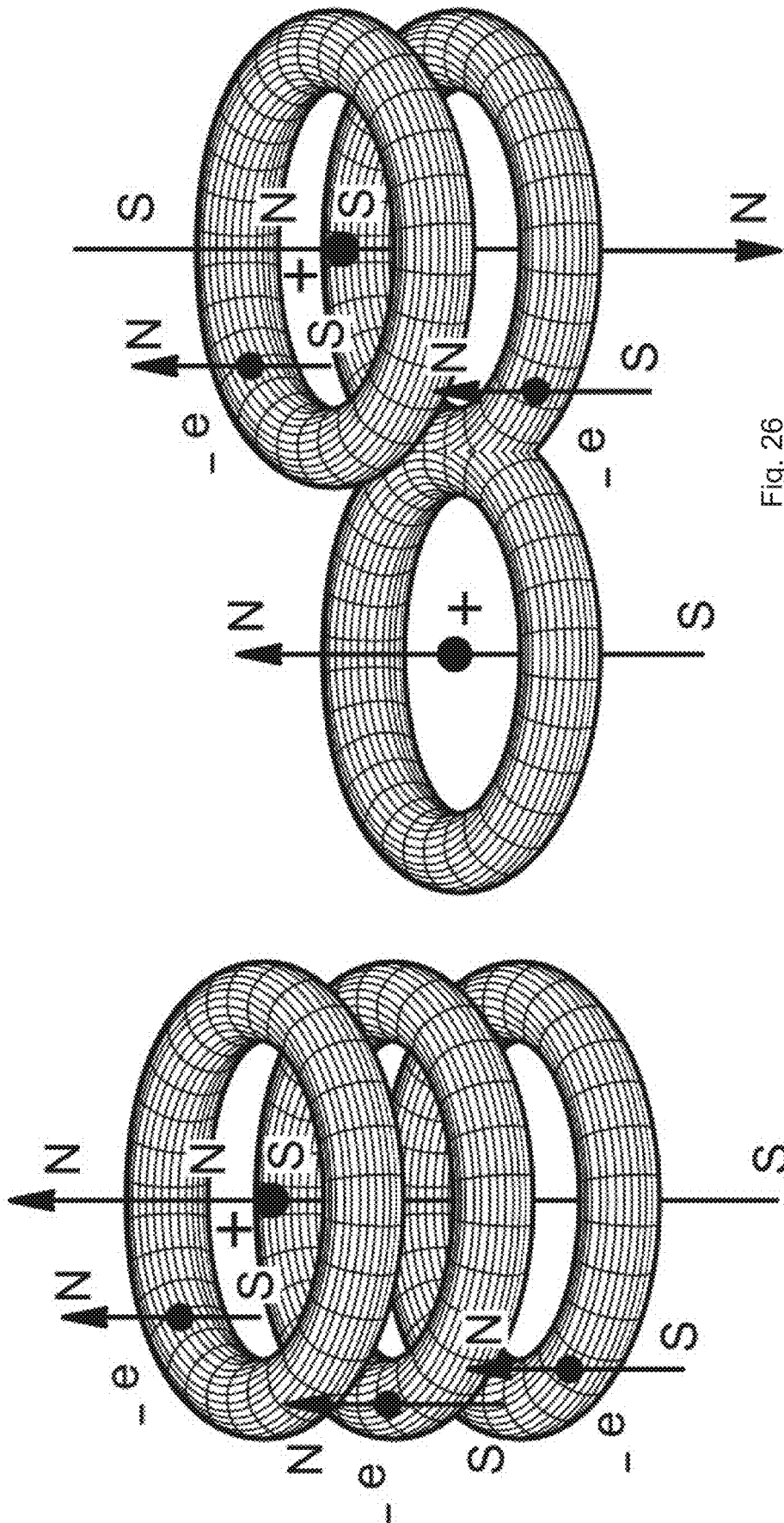
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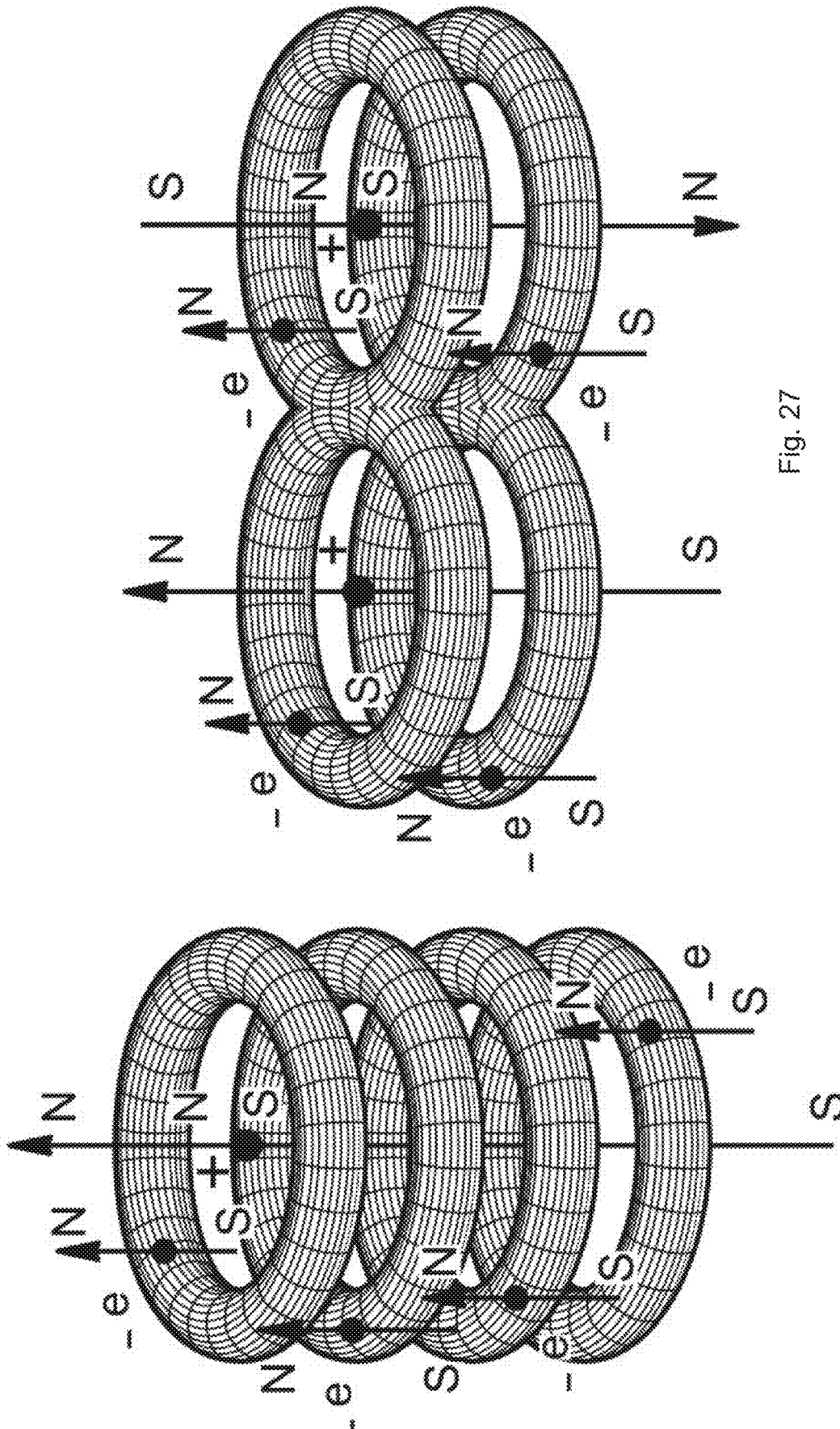
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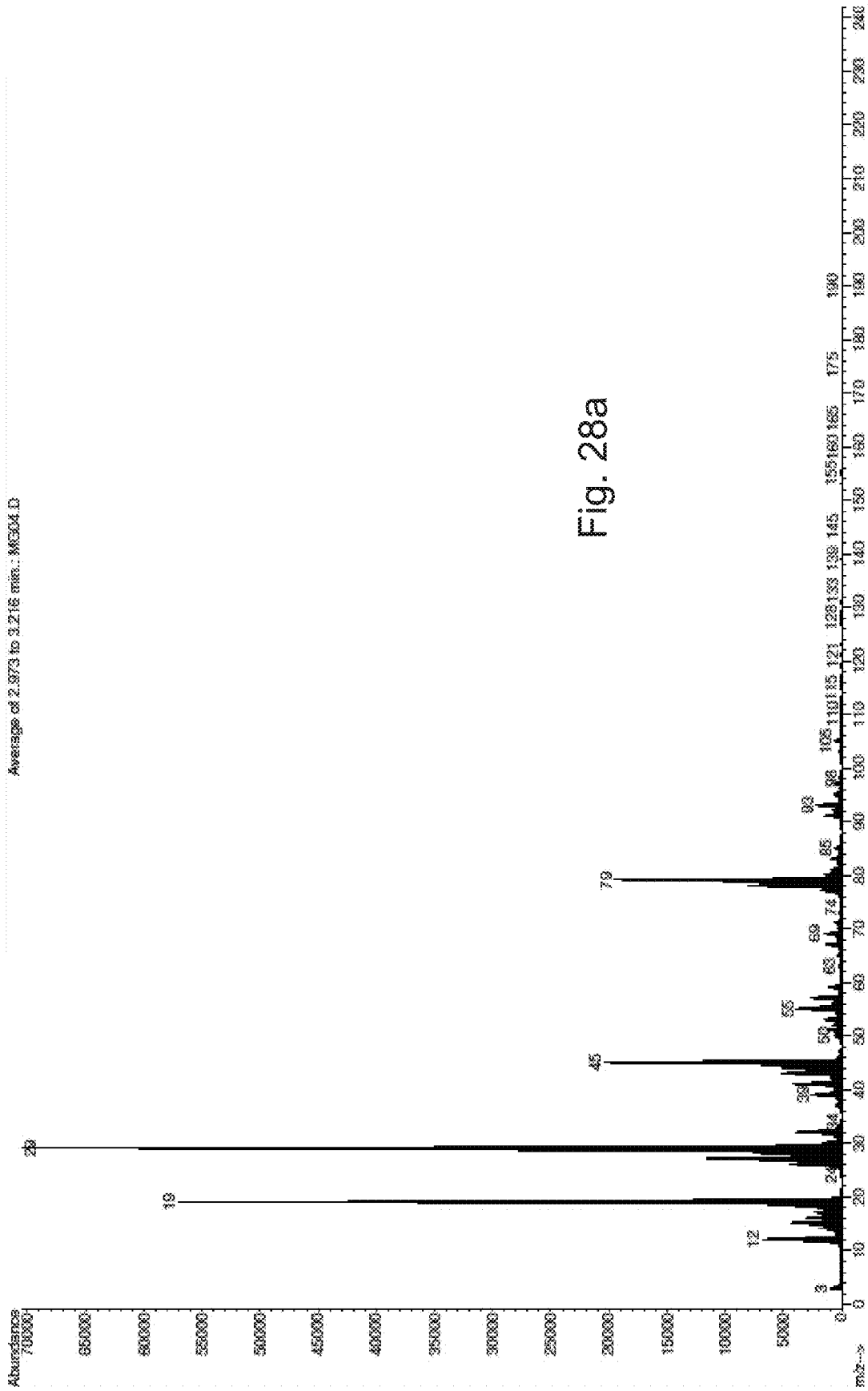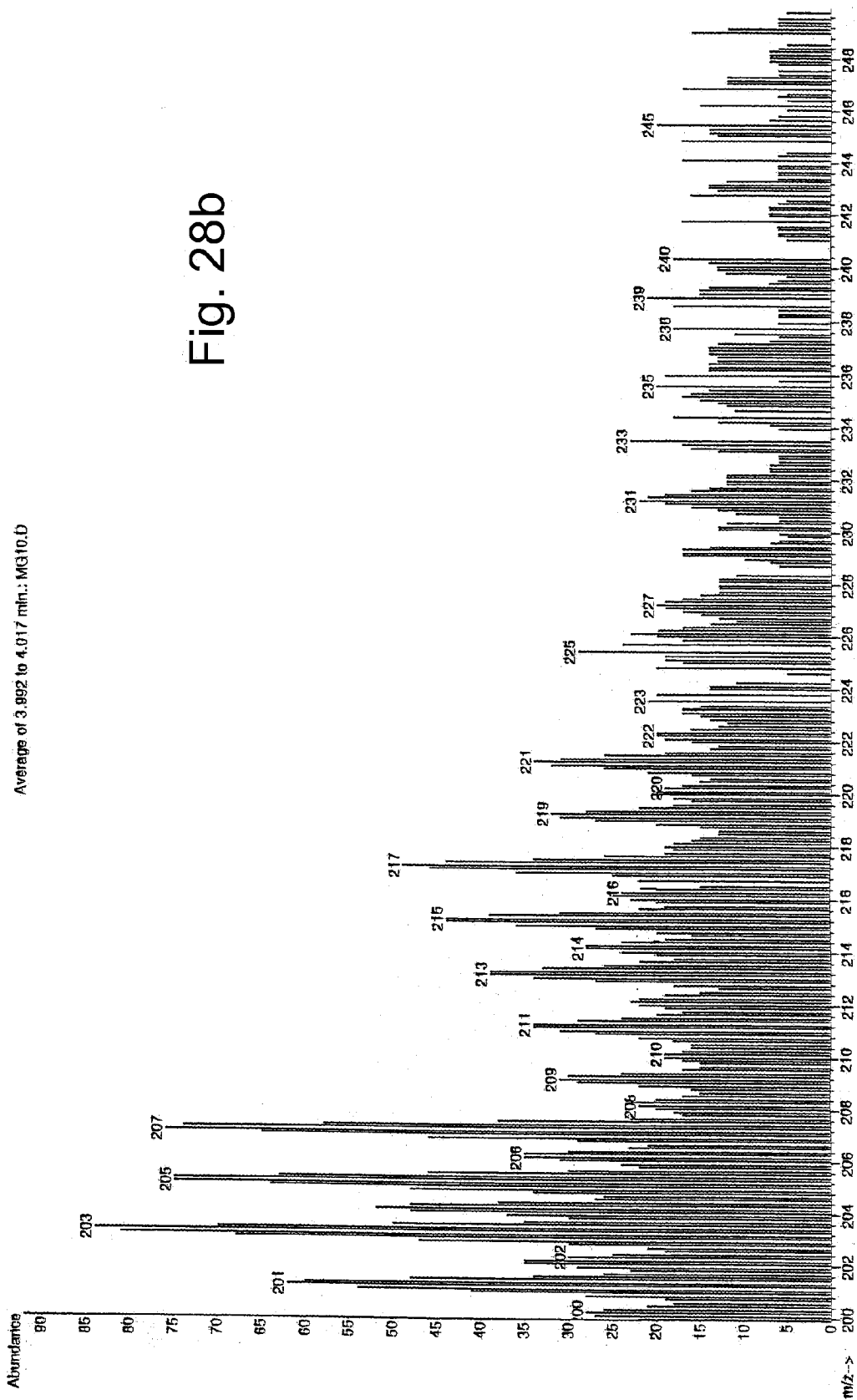
Fig. 28a

Fig. 28b
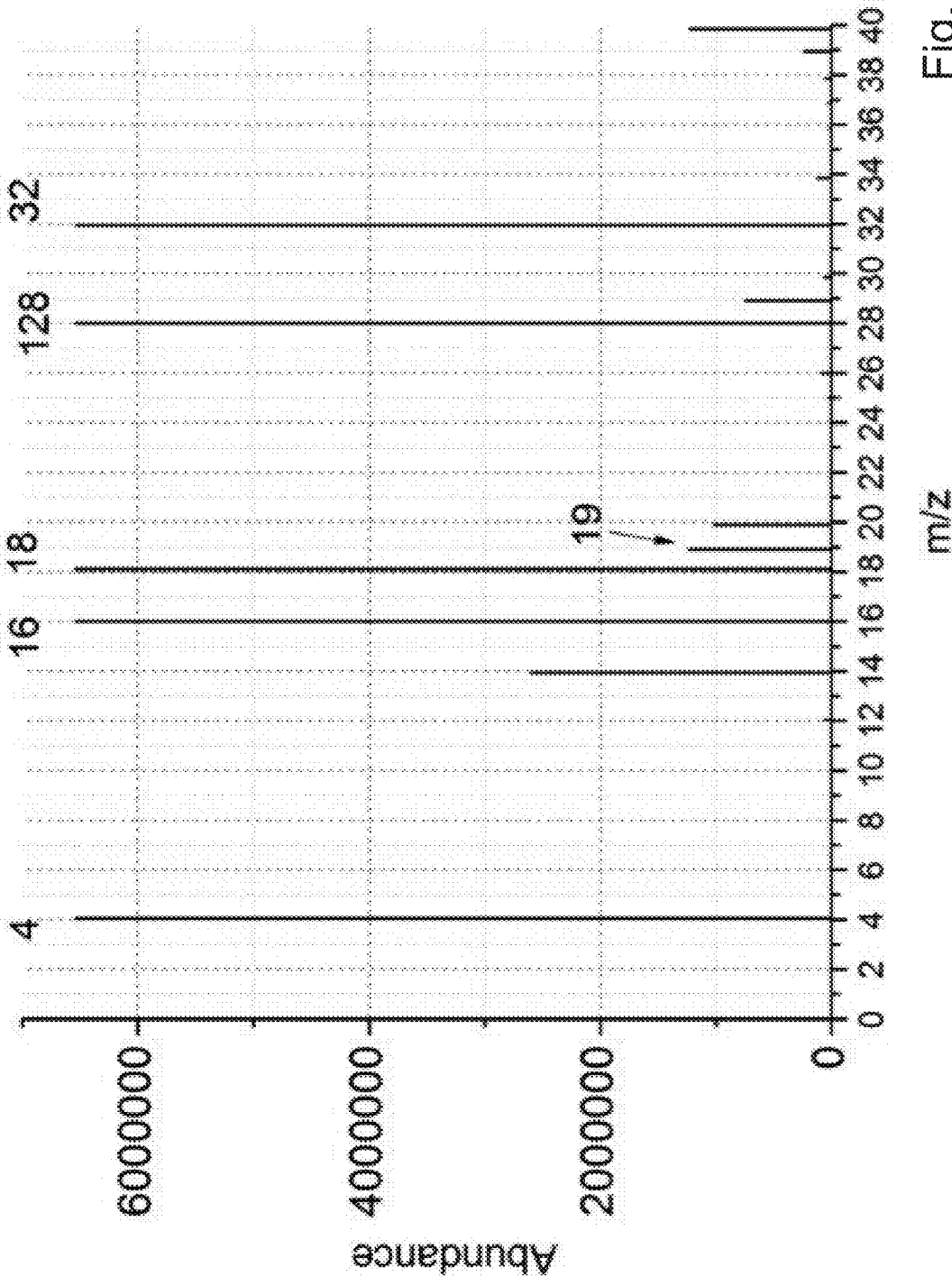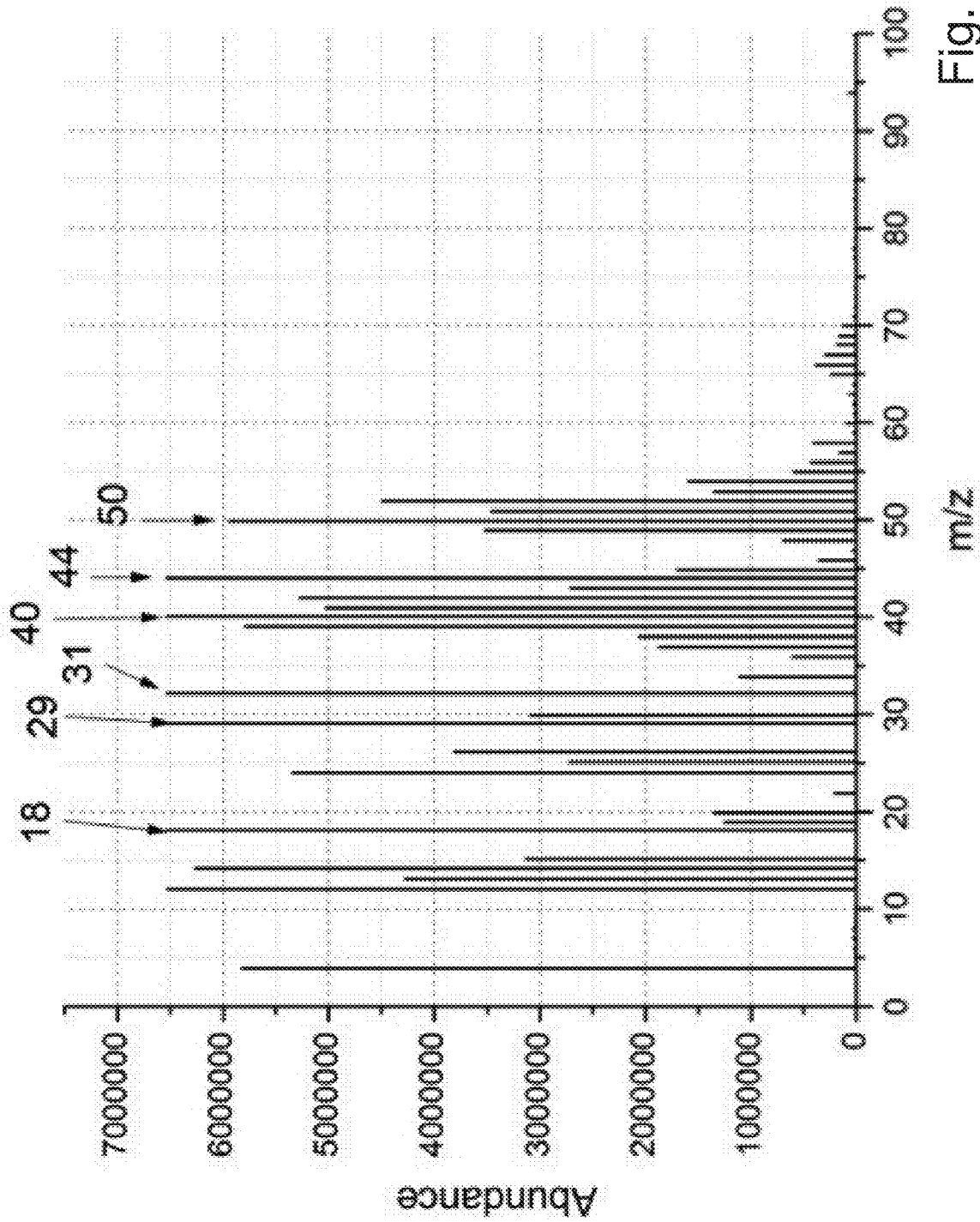
Fig. 29a

Fig. 29b

Fig. 29c
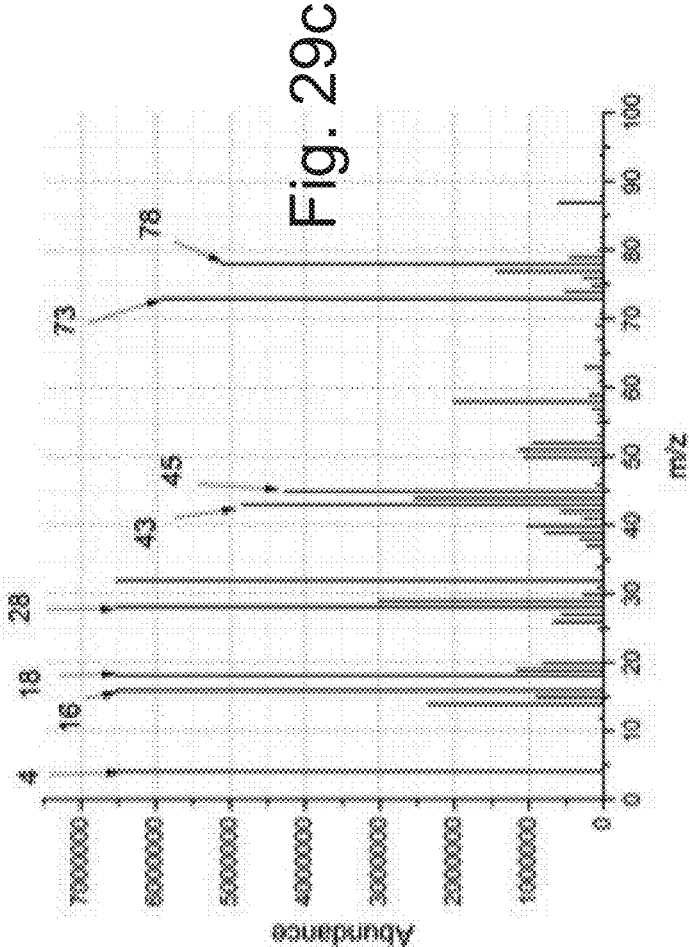
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DATE TESTED   8/7/2012
QUANTITY TESTED   1
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Mass	6	371	Mass	42	18,092
Mass	11	41	Mass	43	8,817
Mass	12	100,209	Mass	44	48,816
Mass	13	70,767	Mass	45	1,189
Mass	14	106,530	Mass	46	226
Mass	15	407,928	Mass	48	287
Mass	16	485,703	Mass	49	1,496
Mass	17	9,663	Mass	50	4,345
Mass	18	3,436	Mass	51	2,955
Mass	19	1,190	Mass	52	3,280
Mass	22	436	Mass	53	2,480
Mass	24	36,642	Mass	54	2,931
Mass	25	124,295	Mass	55	1,494
Mass	26	600,569	Mass	56	1,886
Mass	27	199,348	Mass	57	199
Mass	28	1,893,663	Mass	58	271
Mass	29	62,519	Mass	63	82
Mass	30	9,496	Mass	65	246
Mass	31	1,017	Mass	66	328
Mass	32	20,274	Mass	67	269
Mass	34	82	Mass	68	120
Mass	36	1,296	Mass	70	136
Mass	37	5,843	Mass	73	417
Mass	38	7,803	Mass	77	82
Mass	39	30,692	Mass	78	346

Fig. 30
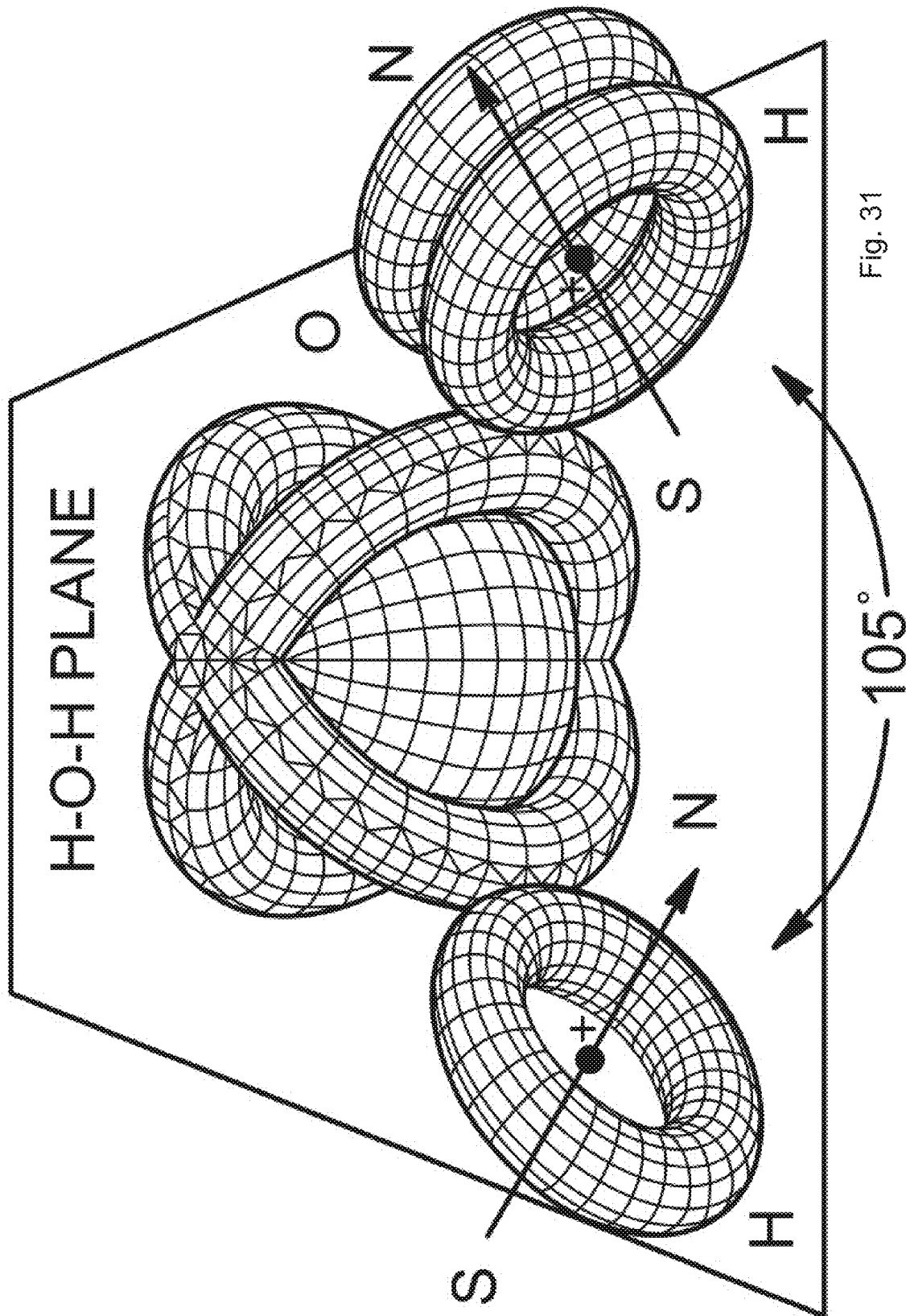
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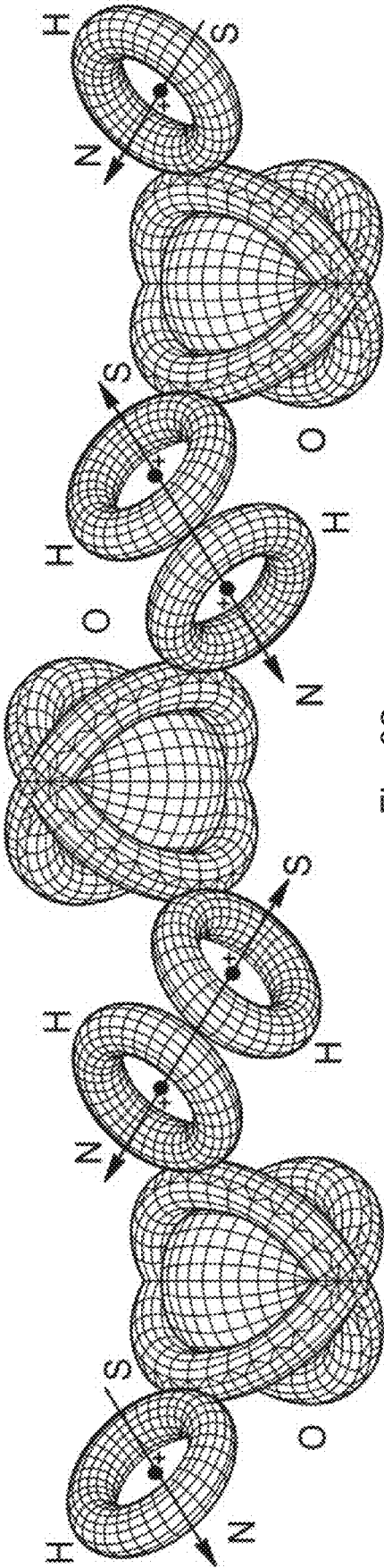
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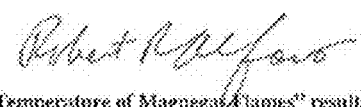
INSTITUTE
FOR
ULTRAFAST SPECTROSCOPY AND LASERS

March 5, 2012

To: Magnegas

From: Robert R. Alfano

Subject: Magnegas project "Temperature of Magnegas Flames" results summary

The following is a summary of Magnegas flame temperature measurements and it's comparison to Blackbody Distribution.
Temperature was calculated using Wien's law: $T=(2.9 \times 10^6)/\lambda max$:

1-Temperature of Magnegas Flame from crude oil+Oxygen: 3mm from base and fit with Blackbody. The peak wavelength of the flame is $\lambda max=473nm$. The corresponding temperature is: **T= 6,132 Kelvin (10,578 Fahrenheit; 5,859 Celsius).**

2-Temperature of Magnegas Flame from crude oil+Oxygen when cutting metal at 3mm above the surface of metal while cutting it (approximately 2mm from base of flame) And fit with Blackbody. The peak wavelength of the flame at $\lambda max=739nm$. The corresponding temperature is: **T=3,920 Kelvin (6,597 Fahrenheit; 3,647 Celsius).**

3-Temperature of Magnegas Flame from antifreeze+ Oxygen: 3mm from base and fit with Blackbody. The peak wavelength of the flame at $\lambda max=476nm$. The corresponding temperature is **T= 6,092 Kelvin (10,598 Fahrenheit; 5,819 Celsius).**

4-Temperature of Magnegas Flame from antifreeze+ Oxygen when cutting metal at 3mm above the surface of metal while cutting it (approximately 2mm from base of flame), and fit with Blackbody. The peak wavelength of the flame at $\lambda max=735nm$. The corresponding temperature is: **T=3,943 Kelvin (6,638 Fahrenheit; 3,670 Celsius).**

The flame spectral intensity distribution has a non Blackbody Distribution form.
Additional details are provided in a separate report.
The measurements were performed by Hani Ahmar and Yuri Budansky on February 15th-18th, 2012

Fig. 33
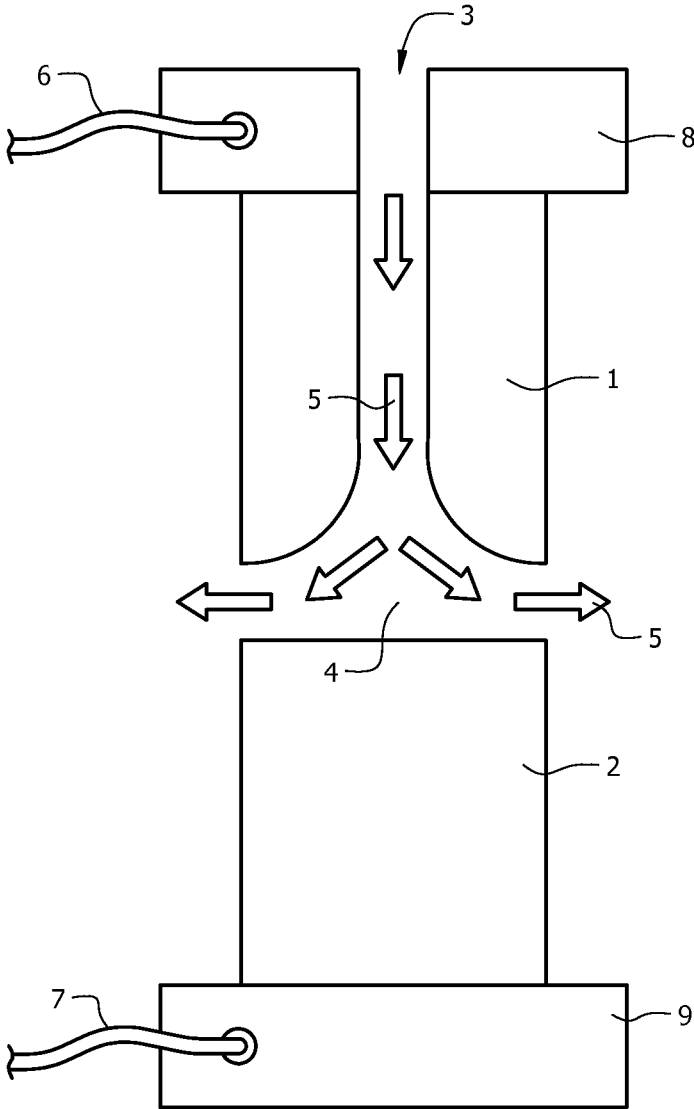
FIG. 34
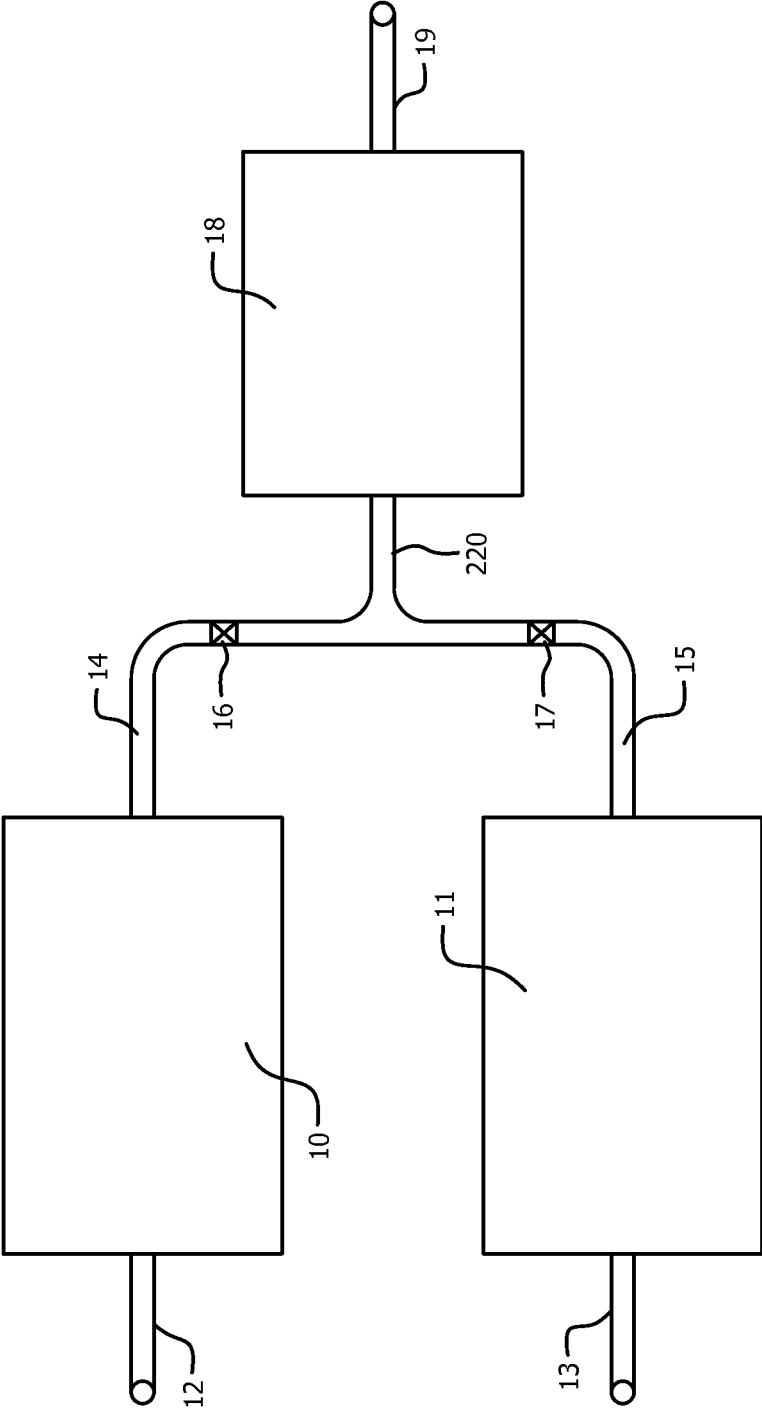
FIG. 35
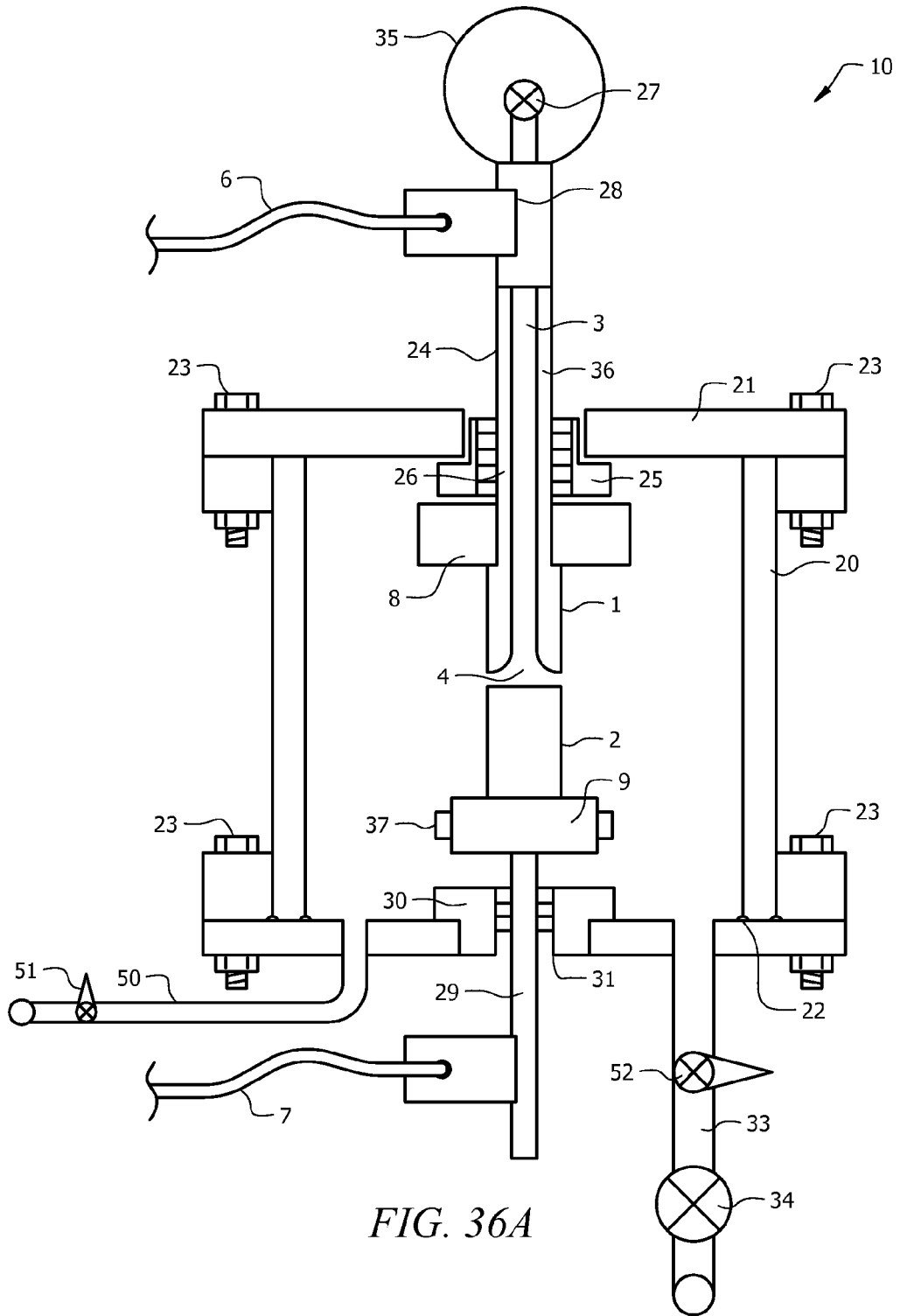
FIG. 36A
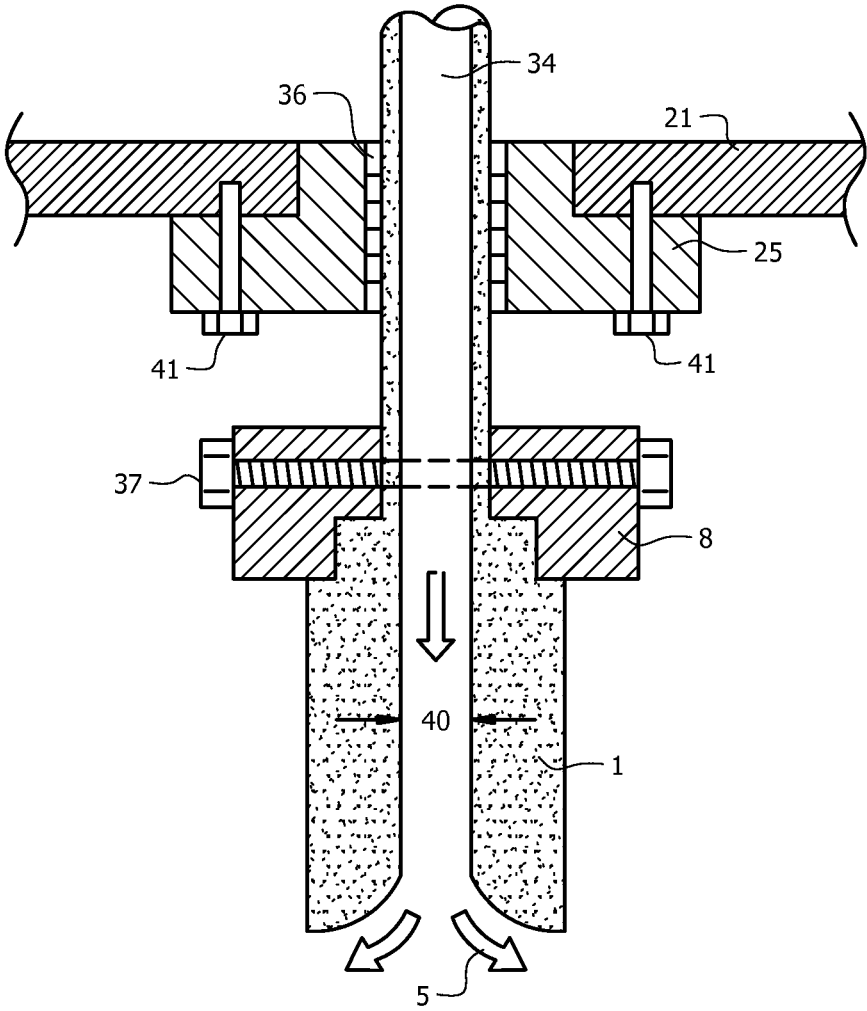
FIG. 36B
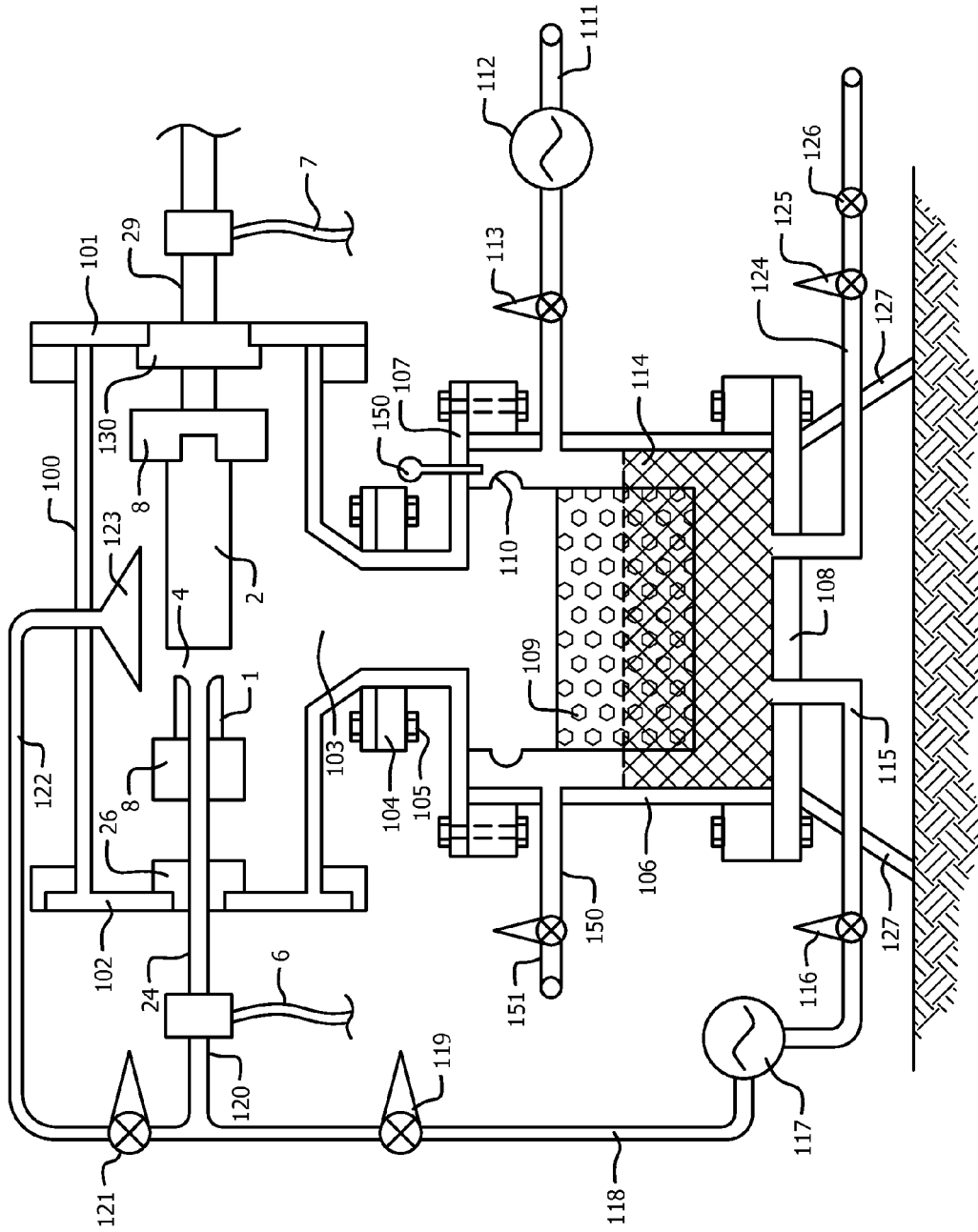
FIG. 37
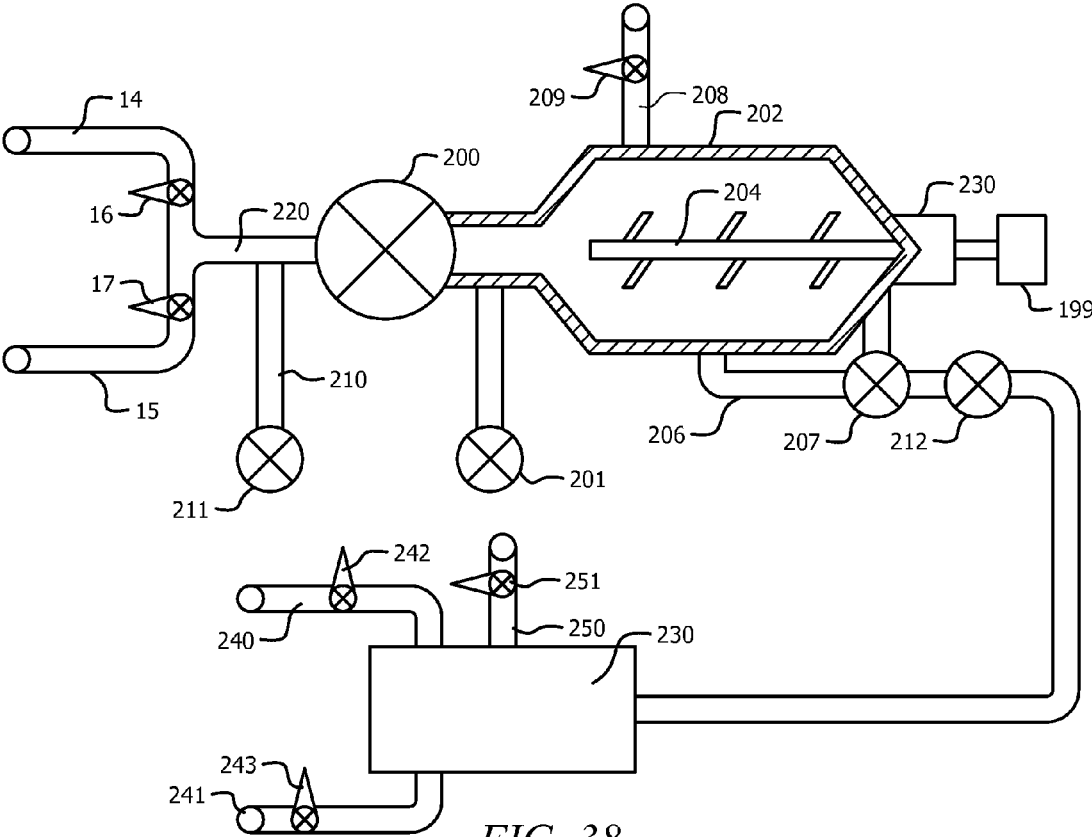
FIG. 38

METHOD AND APPARATUS FOR THE INDUSTRIAL PRODUCTION OF NEW HYDROGEN-RICH FUELS

CROSS-REFERENCE TO RELATED APPLICATION

This application is non-provisional application of provisional patent application Ser. No. 61/808,951, filed Apr. 5, 2013

FIELD

This invention relates to the field of molecular science and more particularly to a system for polarization of the orbits of atomic electrons via sufficiently strong magnetic fields suitable to create in the atomic structure not existing in the natural state of said atoms.

BACKGROUND

In U.S. Pat. No. 6,673,322 which is incorporated by reference, theoretical and experimental evidence on the existence of the new chemical species of magnecules defined as clusters of individual atoms (H, O, C, etc.), dimers (HO, CH, etc.) and ordinary molecules (H_2, CO, H_2O, etc.) bonded together by attractive forces between opposing magnetic polarities of toroidal polarizations of atomic orbitals, as well as the polarization of the magnetic moments of nuclei and electrons (a conceptual rendering is shown in FIG. 1).

The name "magnecules" is used to distinguish the new species from conventional "molecules" (namely stable clusters of atoms solely under the conventional valence bond), as well as to indicate the primary magnetic origin of the new bond. The dash symbol "—" is widely used to denote valence bond (such as H—H) while the multiplication symbol "×" is used to denote magnecular bond (such as H×H).

An assertion of the above patent is that the toroidal polarization of the electron orbitals creates a magnetic field (due to the rotation of the electrons within said toroid) which does not exist for the same atom when the electron orbitals have the conventional spherical distribution.

When two so polarized atoms are at a sufficiently close distance, the resulting total force between the two atoms is attractive because all acting forces are attractive except for the repulsive forces due to nuclear and electron charges. However, the latter forces can be averaged to zero in first approximation since the individual atoms have a null total charge. Alternatively, individual atoms can be assumed in first approximation to have a null total charge distribution, resulting in the evident dominance of the attractive magnetic forces between two atoms with toroidal polarization of their orbitals as shown in FIG. 1.

U.S. Pat. No. 6,673,322 discloses the creation of a gas with the new magnecular chemical structure, currently in industrial production known as MagneGas™. In this, the polarization of the electron orbitals from their natural spherical distribution to the needed toroidal form requires extremely high magnetic fields (expected to be of the order of 10^{10} Gauss or more) that, as such, are not available in our macroscopic environment.

Therefore, for the creation of the new magnecular species, a DC electric arc between graphite electrodes submerged within a liquid (e.g., distilled water) is used. The arc decomposes the liquid molecules into mostly ionized atoms

by creating between the tip of the electrodes a plasma composed by H, C, and O individual atoms, CH and OH dimers and ordinary molecules such as CO, H_2O and others. At atomic distances from said electric arc, the magnetic field does indeed have the desired strength since said magnetic field is inversely proportional to the distance (on the order of 10^{-8} cm) and directly proportional to the electric current (on the order of 10^3 ampere or more), thus having a strength on the order of 10^{11} Gauss which is sufficient to achieved the desired toroidal polarizations of the electron orbitals (see FIG. 2).

Additionally, the strong magnetic field surrounding a DC arc naturally aligns polarized atoms in the needed sequence of magnetic polarities South-North-South-North, etc. resulting in the configuration shown in FIG. 1.

As soon as the arc abates, the atoms return to their natural spherical distribution due to collisions and other reasons. The main argument is that the spherical distribution is indeed recovered but for the bonded pairs of polarized atoms as shown in FIG. 1. This spherical distribution cannot be returned to for each individual atom of the bonded pair due to insufficient energies to break said bond.

Considerable experimental evidence on the existence of the new species of magnecules for a gas created via the above reviewed method is described in U.S. Pat. No. 6,673, 322. In such, measurements were achieved via the use of a Gas Chromatographer Mass Spectrometer equipped with an Infrared Detector, namely a GC-MS/IRD.

All gas chromatographic equipment available in the early 2000's were conceived and developed for the detection of molecules. Therefore, the only possibility available at that time to establish the existence of the new species of magnecules was that of subjecting the same injection, first to detection via the GC-MS and then detection via the IRD.

The identification of clear clusters in the GC-MS that have no IR signature establishes the lack of presence of valence bonds in type indicated clusters, since that would require perfect spherical shape which is impossible for clusters at large a.m.u. values. Once the valence bond was eliminated by experimental evidence, the magnecular bond became the sole plausible alternative due to the means of creation of the species here considered.

U.S. Pat. No. 6,673,322 shows that it was impossible to achieve the same results in a resolutory way via two separate instruments, the GC-MS and the IRD due to the impossibility of matching without ambiguities scans in the GC-MS with scans in a separate IRD.

Gas chromatographic analyses reported in U.S. Pat. No. 6,673,322 were conducted via a GC-MS/IRD consisting of a HP GC model 5890, a HP MS model 5972, and a HP IRD model 5965 operated in rather unusual conditions described in details, such as: largest available feeding line of at least 0.3 mm ID; cryogenic cooling of the feeding line; lowest available column temperature of 100 C.; longest available elusion time of about 25 m; and other conditions.

Representative chromatographs out of a considerable number of scans from U.S. Pat. No. 6,673,322 are reported in FIGS. 3, 4, and 5. This reports the confirmation of the results (here not reproduced for brevity) obtained via an identical GC-MS/IRD located.

This patent also provided considerable experimental evidence for the existence of magnecules in liquids, and comments on the expected existence of magnecular bonds in solids.

The scientific literature in the new chemical species of magnecules is now significant. A first update was made available in the monograph by R. M. Santilli, The New Fuels

with Magnecular Structure, International Academic Press (2005.) A recent comprehensive list of publications in the field has been made by Y. Yang, J. V. Kadeisvili, and S. Marton, in the paper entitled "Experimental confirmation of the new chemical species of Santilli MagneHydrogen," which is expected to publish after the filing of this Patent Application.

Following the original discovery of the new species of magnecules, confirmation was difficult due to a variety of difficulties of one skilled in the art of independent verifications.

The primary difficulty has been the fact that all currently available gas chromatographic equipment has been conceived, developed and tested for the detection of clusters of atoms under the conventional valence bond that, being notoriously strong, allows for comparatively strong detection means (such as ionization, thermal conductivity. etc.) without destroying the species to be detected.

By contrast, magnecular bonds are much weaker than valence bonds by conception and industrial realization, so as to allow full combustion (see U.S. Pat. No. 6,673,322). Therefore, detection equipment and procedures that are unquestionably valid for molecules may in reality destroy the very magnecular species to be detected, unless appraised with care, caution and objectivity.

One of the difficulties is the existence of a very large number of conventional molecules identified so far, apparently of the order of 750,000. Whenever a chemical species is identified in a GC or a GC-MS, it is rather natural for experienced analysts to assume that it merely consists of either a known conventional molecule, or a molecule yet to be identified, thus denying the possibility for chemical novelty. Consequently, testing of gases with magnecular structure at various analytic laboratories around the world turned out to be scientifically sterile.

Another difficulty was caused by the understandable tendency by senior analysts to assume that any chemical anomaly (that is, novelty over established 20th century knowledge) is due to a malfunction of the instrument, in which case all efforts are generally made to modify the operation of the instrument (by increasing the column temperature, decreasing the elusion time, etc.) until conventional results are obtained without any chemical novelty.

Further difficulties have been created by the fact that the chemical novelties of magnecular species are generally dismissed a priori by analysts, thus preventing their serious experimental confirmation or dismissal.

As an example, magnecular gases have an anomalous adhesion to most substances, including paramagnetic ones (because magnetization by induction occurs at the atomic, rather than molecular level). Following a test with a GC-MS and a conventional flushing of the instrument, the background generally retains most of the peaks detected during the normal test (see the documentation in U.S. Pat. No. 6,673,322).

Analysts generally consider this occurrence a malfunction of the instrument, and often send it to the manufacturer for service, rather than admitting an essentially new chemical occurrence deserving inspection.

In reality, the conventional, background is readily recovered by flushing the instrument with a hot inert gas (such as Nitrogen at 400° C.), by confirming in this way the sensitivity of magnecular species on the temperature, as expected for all magnetic polarizations.

Other difficulties occur in detecting magnecules with the recent generation of gas chromatographic equipment using capillary feeding lines, because the lines rapidly clog up

following the injection of a magnecular gas due to its anomalous adhesion, thus providing the analyst the mere illusion of analyzing the gas, while in reality the gas to be tested did not reach the column in the necessary volume.

In one case, a major U. S. analytic laboratory equipped with the most advanced GC-MS dismissed its signed report on the commercially produced and sold MagneGas. In essence, the analyst calibrated the GC-MS for air, flushed the instrument via established procedures, injected MagneGas into the capillary feeding line, conducted a variety of measurements, and released a signed report according to which MagneGas was contaminated with at least 30% air.

Another analytic laboratory conducted the analysis of MagneGas, first of all, with a GC-MS having a large feeding line, and second by using the proceedings for its proper detection, after which MagneGas resulted as having no air contamination at all.

This decade long inability to repeat the original experimental evidence in the existence of magnecules as depicted in FIGS. 3, 4, and 5 confirmed that the best gas chromatographic equipment for the scope here considered is the original one used by the inventor, namely, a GC-MS/IRD as originally used in 1998.

We are here referring to the principle of jointly testing the same gas with two different spectrometers, the GC-MS for the identification of the clusters composing the species, and the IRD for the verification that the bond responsible for the clusters is not a valence type.

In particular, a molecular interpretation should be accepted not only when the clusters at the GC-MS are identified by the instrument as being known molecules, but also when their known IR signature is confirmed in the IRD at the a.m.u. value of the cluster," and not at smaller a.m.u. values, since the latter refer to the conventional constituent of the cluster. Due to the protracted difficulties with contemporary equipment, the same instruments used during the discovery of magnecules are used, consisting of a GC-MS/IRD consisting of a HP GC model 5890, a HP MS model 5972, and a HP IRD model 5965 equipped with a HP Ultra 2 column 25 m long, 0.32 mm ID, and film thickness of 0.52 um, with temperatures starting at 10° C. for 4 min, then incrementally raised to 250° C. at 10° C./min.

The production and service of the above identified GC-MS/IRD had been discontinued one decade ago. Therefore, the desired instrument had to be restored. Such a restoration was commissioned to Spectral Scientific Incorporation (SSI) 38 McPherson Street, Markham, Ontario, Canada, making sure that there was no "upgrade" made to the instrument, Such an upgrade would have likely prohibited the desired measurements.

Following about two years of laboratory work, SSI delivered the fully restored and operational GC-MS/IRD in early 2012, and tests were initiated immediately thereafter.

The following additional instrument was needed to achieve a comprehensive verification or dismissal of the measurements made in 1998. In essence, the chromatographic equipment that had systematically dismissed the existence of the new species of magnecules is the GC-TCD. However, contemporary GC-TCD are definitely not recommendable for analyses of magnecular gases due to the use of capillary feeding lines and undesired detection procedures.

Consequently, an old GC-TCD comprising a HP model 5890-2T and a HP GC model 5890 Series II equipped with two columns, one being a packed-column 80/100 mesh, and the another being a molecular-Sieve 5A Column. These devices were refurbished by Global Medical Instruments, Inc. 6511 Bunker Lake Blvd, Ramsey. Minn., U.S.A. Again,

special attention was made to prevent damaging upgrades during the restoration. Following about one year of laboratory work, the desired instrument was delivered also in full operational conditions in early 2012, and tests were initiated immediately thereafter.

Among a large number of additional chemical analyses of gases with magnecular structure accumulated in a decade of studies, a representative scan was obtained by Oneida Research Services, 8282 Halsey Rd, Whitesboro, N.Y., via IVA 110s equipped with a vacuum chamber (with air-cooled turbomolecular pump), sample inlet with temperature control system and monitor, high performance quadrupole mass spectrometer system, interchangeable electro-pneumatic and manual sample piercing system, electro-pneumatic vacuum isolation valves, inlet pressure monitor for pumpdown, automatic calibration port, computer-controlled sampling valve and valve switching panel (VSP).

The used IVA 110s has a system sensitivity better than 100 ppmv for moisture and better than 10 ppmv for other gases and a system accuracy of 5% at 5000 ppmv. Also, the IVA 110s utilizes a NIST (National Institute of Standards and Technology) Mass Spec Database of more than 250,000 spectra with IVACS interface for use in identification of unknowns. Systematic measurements were conducted on MagneGas fuel that confirmed all originally claimed anomalous characteristics of the new species of magnecules as reported in FIGS. 5 to 33, including:

Characterization of magnecules by weakly bonded individual atoms, dimers, and conventional molecules;

Stability of magnecules at ambient temperature;

Progressive reduction of magnecules with the increase of the temperature;

Termination of magnecules at a suitable Curie temperature;

Detection of magnecular clusters under a suitably selected and operated GC-MS;

Transparency of magnecules to infrared detectors at the a.m.u. of the clusters (and not at smaller a.m.u. characterizing constituents);

Dependence of detected magnecules from the elusion time;

Dependence of magnecular species from filtration and compression;

Anomalous adhesion of magnecular gases to disparate materials;

Anomalous mutation of magnecular clusters under different detection procedures;

Anomalous accretion of magnecular clusters by individual atoms; and other features. Among a considerable number of tests that remains to be done for advances in the new chemical species of Santilli magnecules, we mention the need to achieve experiment identification of molecular and magnecular species having the same a.m.u.

The Figs. show a large variety of analyses by qualified independent laboratories, depending on the selected liquid feedstock, MagneGas fuel contains from 30% to 35% Carbon Monoxide referred to the triple-bonded molecule C—O. These analyses are "good faith experimental beliefs," in the sense that the instrument says so and that is believed to be true without due scientific caution caused by the absence of independent chemical analysis on the same gas done with a different instrument.

In the event MagneGas did indeed contain 30% to 35% CO, exhaust from combustion would be expected to contain at least 25% Carbon Dioxide CO_2 (since CO is combustible). Independent certification of MagneGas combustion

has established the presence of about 5% CO_2 in said exhaust, about 0.01% CO, up to 14% breathable Oxygen O_2, no appreciable HC and NOx in ppm, the rest being water vapor (since MagneGas contains from 60% to 65% Hydrogen). It is evident that the sole presence in Magnegas exhaust of about 5% CO_2 and no appreciable combusted CO does indeed render the 30% to 35% CO in MagneGas a "belief."

U.S. Pat. No. 6,673,322 provides contrasting data. In essence, the chemical species detected by GC-MS in MagneGas at 28 a.m.u. is composed partially by the conventional Carbon Monoxide C—O and partially by the magnecular bond of the same atoms C×O essentially in the configuration of FIG. 1. The high percentage of CO detected in MagneGas by various laboratories is in effect created by the equipment itself. Due to the known affinity between Carbon and Oxygen, the following reaction is in effect a possible reaction C×O+trigger→CO+heat, where the "trigger" is the detection mechanism of the instrument, and the release of heat is due to the fact that molecular bonds are much stronger than magnecular bonds.

Also, high collisions occurring in combustion are expected to breakdown the weakly bound magnecule C×O and produce the excess Oxygen needed to reach a quantitative understanding of the MagneGas exhaust. The above scenario is so unknown that caution is suggested in predicting the percentage of CO in existing in MagneGas from the measured percentage of CO_2 in the exhaust (expectedly of about 7%). Available experimental data cannot exclude the possibility that the entire content of the species in MagneGas with 28 a.m.u. can be the magnecule C×O, and the expected 7% CO can, in effect, be created by collisions during combustion.

SUMMARY

In one embodiment, a method for bonding a fluid to a substance is disclosed including independently exposing the fluid and the substance to magnetic fields sufficiently strong to cause a toroid polarization of the orbits of at least some of the atomic electrons contained therein to create an axial magnetic field, thereby creating a polarized fluid and a polarized substance. Upon exposing the polarized fluid to the polarized substance at a sufficient pressure, a bond is achieved between opposing polarities of said toroid polarization.

In another embodiment, an apparatus for the creation of a bond between a gas and a substance is disclosed including at least one pressure vessel containing in its interior at least one set of electrodes, between which an electric arc is created, plumbing for the passing of a gas through the electric arc thereby creating a treated gas, a control system for controlling the electric arc, and plumbing for the collection of the treated gas. At least one pressure vessel includes a device for exposing a substance to a magnetic field, thereby forming a polarized substance. A chamber is included for exposing the treated gas to the polarized substance under pressure, wherein the treated gas is conducted into the polarized substance producing a treated substance.

In another embodiment, an apparatus for bonding a fluid to coal is disclosed including a device for exposing the fluid to at least one electric arc formed between at least one pair of electrodes creating a treated fluid; and a device for exposing the treated fluid to coal.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be best understood by those having ordinary skill in the art by reference to the following detailed description when considered in conjunction with the accompanying drawings in which:

FIG. **1** illustrates a schematic view of toroidal polarizations of the orbits of atomic electrons exposed to magnetic forces.

FIG. **2** illustrates a schematic view of toroidal polarizations of the orbits of atomic electrons two atoms exposed to magnetic forces from a DC arc.

FIG. **3** illustrates experimental measurements.

FIG. **4***a* illustrates experimental measurements.

FIG. **4***b* illustrates experimental measurements.

FIG. **5** illustrates experimental measurements.

FIG. **6***a* illustrates experimental measurements.

FIG. **6***b* illustrates experimental measurements.

FIG. **7***a* illustrates experimental measurements.

FIG. **7***b* illustrates experimental measurements.

FIG. **8***a* illustrates experimental measurements.

FIG. **8***b* illustrates experimental measurements.

FIG. **9***a* illustrates experimental measurements.

FIG. **9***b* illustrates experimental measurements.

FIG. **10***a* illustrates experimental measurements.

FIG. **10***b* illustrates experimental measurements.

FIG. **11** illustrates experimental measurements.

FIG. **12** illustrates an analysis of Hydrogen with toroid polarization.

FIG. **13***a* illustrates experimental measurements.

FIG. **13***b* illustrates experimental measurements.

FIG. **14***a* illustrates experimental measurements.

FIG. **14***b* illustrates experimental measurements.

FIG. **15***a* illustrates experimental measurements.

FIG. **15***b* illustrates experimental measurements.

FIG. **16***a* illustrates a magnecular structure composed by a mixture of molecular and magnetically bonds.

FIG. **16***b* illustrates a magnecular structure composed by a mixture of molecular and magnetically bonds.

FIG. **17** illustrates experimental measurements.

FIG. **18** illustrates experimental measurements.

FIG. **19** illustrates experimental measurements.

FIG. **20** illustrates experimental measurements.

FIG. **21***a* illustrates experimental measurements.

FIG. **21***b* illustrates experimental measurements.

FIG. **22***a* illustrates experimental measurements.

FIG. **22***b* illustrates experimental measurements.

FIG. **23** illustrates experimental measurements.

FIG. **24** illustrates experimental measurements.

FIG. **25** illustrates polarized atoms.

FIG. **26** illustrates polarized atoms.

FIG. **27** illustrates polarized atoms.

FIG. **28***a* illustrates an analysis of $H_3O=H-O-H \times H$.

FIG. **28***b* illustrates an analysis of $H_3O=H-O-H \times H$.

FIG. **29***a* illustrates experimental measurements.

FIG. **29***b* illustrates experimental measurements.

FIG. **29***c* illustrates experimental measurements.

FIG. **30** illustrates experimental measurements.

FIG. **31** illustrates polarized atoms.

FIG. **32** illustrates polarized atoms.

FIG. **33** illustrates a summary of measurements conducted by scientists of the Institute of UltraFast Spectroscopy and Lasers.

FIG. **34** illustrates a Plasma-Arc-Through apparatus.

FIG. **35** illustrates detail parts of the reactor.

FIG. **36**A illustrates an exemplary reactor.

FIG. **36**B illustrates a second exemplary reactor.

FIG. **37** illustrates a liquid fuel polarization reactor.

FIG. **38** illustrates a fuel/gas combining apparatus.

DETAILED DESCRIPTION

Reference will now be made in detail to the presently preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. Throughout the following detailed description, the same reference numerals refer to the same elements in all figures.

In the following, the term "fluid" is used to denote either a gas or a liquid; the term "substance" is used to denote the a gas or a liquid or a solid; the terms "atomic orbit" or "atomic orbital" is referred to the orbit of peripheral atomic electrons as established by quantum mechanics; the terms "magnetic polarization" is used to denote the control of the orientation via magnetic fields of at least some of the orbits of atomic electrons, thus being of atomic, rather than molecular character; the terms "toroidal polarizations" or "toroid polarization" refer to the magnetic polarization of the orbits of at least some of the atomic electrons into toroids of the type illustrated in FIG. **1**; the terms "magnecular bonding" or "magnecular bond" refer to the attraction between opposing magnetic polarities of toroidal polarizations of the orbits of atomic electrons as also illustrated in FIG. **1**; the term "magnecules" refers to clusters of atoms, dimers and ordinary molecules under a magnecular bond; the symbol "—" is used to denote molecular (valence) bond as in the water molecule $H_2O=H-O-H$ and the symbol "×" is used to denote magnecular bond such as in the new species $H3O=H-O-H \times H$ of the analysis of FIG. **28**; the terms "axial magnetic field" or "perpendicular magnetic field" refer to the property that the magnetic field of a toroid polarization of atomic orbits exists along the symmetry axis of said toroid, thus being perpendicular to the toroid symmetry plane; the term "MagneHydrogen" and its symbol MH refer to the species of Hydrogen with toroid polarization of its atomic orbitals resulting in magnecular bonding of its atoms essentially along the chemical analyses of FIGS. **12** to **18**, thus having specific weight greater than the conventional specific weight of $H_2=H-H$; the terms "MagneOxygen" and its symbol MO, "MagneNitrogen" and its symbol MN, "MagneCarbonMonoxyde" and its symbol MCO, and other gases refer to the new form of said gases caused by the toroidal polarization of the atomic orbitals resulting in specific weight bigger than those of conventional values; the term 'MagneGas" and its symbol MG are referred to a gas composed by H, O, C and other atoms under magnecular bond, thus admitting molecular bonds as constituents of magnecular clusters; the term "MagneLiquid" and its symbol ML refer to a liquid with toroid polarization of at least some of the orbits of their atomic electron and resulting magnecular bond, thus admitting molecular bonds as particular case; The terms "pipe" and "line" are used in this invention under the same meaning referring to a tube capable of delivering a fluid.

The novel method herein presented is based on the anomalous adhesion of magnetically polarized Hydrogen, Oxygen and other elements to other substances, as experimentally established via numerous experimental measurements, such as those reported in FIGS. **3** to **24**.

In fact, such anomalous adhesion permits the industrial production of basically new fuels here individually referred to with the names of Hy-Gasoline, Hy-Diesel, Hy-Coal, and others, and collectively referred to under the name of HyFuels.

These new fuels consists in the magnecular bond of Hydrogen to a conventional fuels, such as gasoline, diesel, coal, etc., the novelty being clearly established by the fact that Hydrogen and the selected conventional fuel are not a mixture, but in a bond which is stable at ambient tempera- ture and any industrially achievable pressure, such as 10,000 psi.

The utility of the above defined HyFuels is clearly estab- lished by the fact conventional fuels release a number of contaminants in their exhaust, some of which are combus- tible, such as Hydrocarbons HC, carbon Monoxide CO and others. But Hydrogen has one of the biggest flame tempera- tures and speeds among all known fuels. Therefore, the presence of Hydrogen during the combustion of conven- tional fossil and other fuels allows the combustion of the combustible contaminants in the exhaust in a way propor- tional to the percentage of bonded Hydrogen, with evident utility.

The utility of the above novel method is further estab- lished by the fact that conventional fossil and other fuels require the catalytic converter in order to be legally used in the U.S.A. Extensive experimentation and measurements conducted by the inventor have established that the bond of at least 10% in BTU units to the BTU content of gasoline allow the elimination of the catalytic converter while veri- fying all current governmental restrictions in the exhaust.

By remembering that one gasoline gallon has about 110,000 BTU, said measurements have established that compliance with governmental exhaust restrictions without catalytic converter is achieved when bonding to said gaso- line gallon 11,000 BTU in Hydrogen. By remembering that one standard cubic foot (scf) of Hydrogen contains about 300 BTU, the above indicated conditions are met when bonding magnecularly to one gasoline gallon 36.6 scf of Hydrogen.

The above utility is best illustrated when applying the new method of this invention to fossil fuel operated electric power plants that, as it is well known, spend hundreds of millions of dollars per plant per year for the cleaning of the contaminants in the exhaust via large scrubbers and other equipment. The combustion of the HyFuels of this invention will, therefore, allow the saving of large sums of money to electric power plants.

In summary, the first principle underlying the new method of this invention is that of "improving the environmental quality of the exhaust of fossil and other fuel by increasing their combustion."

The utility of the new method of this invention is addi- tionally established by the fact that the combustion of combustible exhaust of fossil and other fuels via magnecu- larly bonded Hydrogen evidently increases the power out- put. Quantitatively, the magnecular bond of 10% in BTU values of Hydrogen to one gasoline gallon has been mea- sured to cause the increase of about 30% in power output, of which 10% are constituted by the energy content of the bonded Hydrogen and 20% is constituted by the combustion of combustible contaminants.

Therefore, the second principle underlying the novel method of this invention is that of: "achieving increased power output of fossil and other fuels via the increase of the combustion."

The mechanism of combustion of HyFuels is also impor- tant for the skilled in the art so as to allow their independent verification of the novelty of this invention. For this purpose, we recall the following chemical notions.

Molecular combustion is referred to the combustion of fuels having the conventional molecular structure that is,

said fuels are composed by atoms under the conventional valence bond. A typical example is that of the combustion of H_2 and O_2 with the production of 57.5 Kcal/mole, $H_2+O_2/2 \rightarrow H_2)+57.5$ Kcal/mole. However, a condition to synthesize the H_2O molecule is the poor separation of the H_2=H—H and O_2O—O molecules, which separation requires 221 Kcal/mole. The latter separation energy has to be taken into account in order not to violate the principle of conservation of the energy. Consequently, the combustion of H_2 and O_2 produces in reality 221 Kcal/mole of which the measured energy output of 57.5 Kcal/mole is only the residue.

Magnecular combustion is referred to the combustion of fuels having at least in part a magnecular structure that is, said fuels are composed of atoms under magnecular bond. The novelty important for this invention is that magnecular fuels have a higher energy output than that of molecular fuels under the same atomic constituents because in the firmer case, atoms are "weakly" bonded together, while in the latter case aims are "strongly" bonded together. Alter- natively, the energy needed for the separation of magnecular bonds is a fraction of the energy needed for the separation of molecular bonds. As an example, the combustion of a pure MH2=H×H to a pure MO_2=O×O yields an energy output of about 278 Kcal/mole less the breaking of the magnecular bond expected to be of the order of 50% that of the valence bonds H2=H—H and O_2=O×O. Therefore, the combustion of MH2 and MO2 will produce 50% of 221 Kcal/mole plus 57 Kcal/mole for a total of about 160 Kcal/mole, i.e., MH2+MO2/2$\rightarrow$H$_2$O+160 Kcal/mole. It should be stressed that the numerical value of magnecular bond has not been measured to date with sufficient accuracy. The only established knowledge is that magnecular bonds require smaller separation energy than molecular bonds.

Detailed studied of the magnecular combustion via the use of the covering of quantum chemistry known as had- ronic chemistry (see, e.g., Foundations of Hadronic Chem- istry, with Applications to New Clean Energies and Fuels, R. M. Santilli, Kluwer Academic Publishers, 2001), have clari- fied quantitatively with equations that the advantages of the magnecular over the molecular combustion are due to the "magnetic" origin of the magnecular bond because the latter bond ceases to exist at a given temperature scientifically known as the Curie Temperature.

Consequently, the magnecular bond of Hydrogen or other atoms to other substances automatically disappears at com- bustion whose temperature is the Curie temperature of the bond. Therefore, the scientific, that is, quantitative and numerical, understanding of the anomalous energetic reac- tion MH2+MO$_2$/2$\rightarrow$H$_2$O+160 Kcal/mole is known as had- ronic chemistry, including statistical treatments of instabili- ties, dispersions, non-linear effects, etc.

One skilled in the art can now understand, at least conceptually, the novel combustion of HyFuels because Hydrogen atoms are not bonded to fossil fuel via the strong valence. Instead, said atoms are bonded via the weaker magnecular bond that essentially allows atoms to be free for combustion at the combustion temperature, with consequen- tial higher energy output. This explains the reason that the magnecular addition of 10% in BTU value of Hydrogen to gasoline yields a 30% increase of energy output without any violation of the principle of conservation of the energy.

Yet another utility of the novel method of this invention is the fact that the flame temperature of the commercially sold MagneGas fuel with symbol MG is about double that of Natural Gas NG, as established by numerous measurements conducted by scientists of the Institute of UltraFast Spec- troscopy and Lasers of the City College of New York, and

reproduced in summary in FIG. 33. In fact, Natural Gas has the flame temperature of 3,400 F. while MagneGas has a flame temperature of the order of 10,500 F.

Additionally, Magnegas can cut a 6" thick metal plate much faster than Acetylene 9 see the certifications in www-.magnegas.com), resulting in a clear anomaly. In fact, Acetylene has about 2,400 BTU/scf while a combination of 60% H2, 27% CO and 3% volatile gases has about 320 BTU/scf. When subjected to conventional chemical analyses, Magne-Gas appears as having precisely the indicated composition of about 60% H_2, 27% CO and 3% volatile gases, as the skilled in the art can verified with data available in the internet.

The anomaly is that a combustible gas with only 320 BTU/scf cannot possibly cut a 6" steel plate faster than Acetylene that has 2,400 BTU/scf. The only known scientific, that is quantitative resolution of this anomaly is that MagneGas "is not" composed of atoms under a valence bond but of atoms at least in part under a magnecular bond.

We are now in a position to indicate in these specifications that the Hydrogen contained in HyFuels "is not" conventional hydrogen H_2 with a spherical distribution of its orbits, but MagneHydrogen MH because such a structure is a necessary pre-requisite for the magnecular bond with conventional fossil fuels.

The utility of the novel method of this invention is then further established by the fact that the anomalous combustion temperature of the magnecular Hydrogen contained in HyFuels provided additional utility because of the evident increase of energy output caused by the anomalous combustion of MH.

Following the clarification that the Hydrogen content of HyFuels must have magnetic polarizations, it is important for the skilled in the art to know that the same magnetic polarizations are needed for fossil fuel, unless the polarization can be achieved by induction as it is the case for coal described below. In the absence of aid polarizations for both the Hydrogen and, separately, for the conventional fuel, the magnecular bond between the two substances is generally impossible or rather weak at best.

The novel method for Hy-Coal is somewhat different than those for other HyFuels, because carbon is one of the best paramagnetic substances in nature that, as such, can easily acquire the needed magnetic polarizations via simple industrious. In particular, carbon in coal can indeed acquire the needed induced magnetic polarizations via its exposure to MagneHydrogen, thus implying considerably the apparatus needed for the production of Hy-Coal. However, it should be stressed that the basic principles underlying Hy-Coal are the same as those for the remaining HyFuels since they are all based on the anomalous adhesion of magnetically polarized Hydrogen.

Specifications of Representative New Apparatus:

An embodiment of this invention for the case of liquid HyFuels is that based on the use of conventional Hydrogen and conventional liquid fuel such as gasoline, the magnetic polarization of at least some of their atomic orbits and their magnecular bonding. Another embodiment is for solid HyFuels, such as Hy-Coal, is discussed below.

Referring to FIGS. 32 through 38, several views of a reactor system are shown. An efficient means to achieve the needed magnetic polarization of electron orbits are those based on submerged electric arcs between one or more pairs of electrodes under DC, AC, DC pulsing, AC high frequency and other electric power as specified below. Among the various apparatus available for a submerged electric arc, high efficiency is achieved by the U.S. Pat. No. 8,236,150

B2 titled Plasma-Arc-Through, similar to the apparatus of FIG. 35 of a temperature resistance anode 1 fastened to a conducting, such as copper holder 8, a temperature resistant cathode 2 fastened to a conducting, such as copper holder 9, a hole 3 through one or the other electrode or through both electrodes, and a DC power delivered to the conducting holders 8/9 via electrical connections 6/7. When power is activated, an arc is established in the electrode gap 4. The gaseous or liquid fluid 5 intended for magnetic polarization is passed through the bore 3 in the direction shown in FIG. 34, thus being forced to pass through the gap 4, by therefore assuring the exposure of the fluid to the electric arc.

The polarization of the orbits of natural elements requires very large values of magnetic fields of the order of 10^{10} Gauss or more. Additionally, the achievement of industrial utility requires the bonding of sufficient Hydrogen to the selected liquid fuel, as indicate above, for at least 10% in BTU values. Consequently, industrial utility requires the achievement of magnetic field greater than, for example, 10^{10} Gauss, which have been identified to have at least 10^{11} Gauss. These magnetic fields are achievable at atomic distance from an electric arc under the condition of using at least 300 kW. In fact, the magnetic field M of a DC arc is described by the law M=k I/r, where the current I is measured in Ampere A, r is the distance from the arc measured in cm, and k is a constant depending on selected units whose numerical value is not specified. Therefore, at atomic distances from the electric arc, that is, at about 10^{-8} cm, and for 6,000 A of a DC arc at 50 V powered by 300 kW, produces a magnetic field of the order of 6 k 10^{11} Gauss.

With reference to FIG. 35, a representative liquid HyFuels production plant consists of a reactor 10 for the polarization of Hydrogen entering the reactor via pipe 12 and existing in polarized form via pipe 14 with check valve 16 to prevent the return of the polarized Hydrogen to reactor 10; reactor 11 for the magnetic polarization of the selected liquid fuel entering the reactor via pipe 13 and existing the reactor in a polarized form via pipe 15 with check valve 17 to prevent the polarized liquid returning to reactor 11; the polarized Hydrogen and the polarized liquid fuel acquire the state of a mixture when combined in pipe 220 that enters reactor 18 for their magnecular bond. The desired HyFuels then exit the plant via effluent pipe 19 for collection.

With reference to FIGS. 36A and 36B, an exemplary reactor 10 for the magnetic polarization of conventional Hydrogen H2 comprises: for example, a schedule 40 carbon steel pipe 20 of 2 feet OD and 3 feet length horizontally or vertically oriented and completed with welded on hollow flanges as shown in FIG. 36A, plain flange 21 at one end of said pipe fastened to the hollow flanges via bolts 23, plus a mirror of plane flange 21 and related fasteners at the other end of pipe 20 so as to be able to sustain internal pressure for at least 100 psi; said vessel 20 containing in its interior the electrode assembly shown in detail in FIG. 37B. The electrode assembly comprises a hollow anode 1 of, for example, 5" OD and 5" length and the cathode 3 of 5" OD and 7" length with interconnecting gap 4 of approximately ⅛". The copper holders 8/9 of said electrodes 1/2, respectively, being composed by copper disks of 7" OD and 3" thickness to fasten together the anode and cathode The anode is connected as shown in FIG. 36A to a copper pipe 34 of 2" OD and 1" ID hole 40 and the cathode is connected to a 2" OD copper rod 29 via fasteners 37 shown in FIG. 36B in dashed lines because off center with respect to the disks shaped holders 8/9; The anode assembly is connected to flange 21 by phenolic bushing 35 of, for example, 5" OD and 3" thickness and fastened to a flange 21 via bolts 41. The

phenolic bushings comprise a series of seals **36** assuring the constant maintaining of pressure inside vessel **20** (e.g., 100 psi). The corresponding cathode assembly as shown in FIG. **36**A includes a cathode **2**. The corresponding copper holder **9** is preferably identical to the copper holder **8**; 2" OD copper rod **29**, phenolic bushing **30** and related seals **31** are preferably identical to those for the anode assembly of FIG. **36**B. The copper tube **24** and copper rod **29** protruding outside the plain flanges **21** of vessel **20** as shown in FIG. **36**A in such a fashion to allow electrical connections **6/7**. The Hydrogen polarization reactor **10** is completed with, for example, an aluminum tank **35** for Hydrogen at pressure of 1,500 psi which is connected to pipe **24** via pressure regulator **27**, pipe **33** and related check valve **34** for the existing of polarized Hydrogen. A variety of automatic controls and other peripheral equipment for the initiation, maintaining and optimization of the arc in between the anode and cathode that are not reproduced in FIG. **36**A for brevity and such is described in detail in the U.S. Pat. No. 8,236,150 B2, which is hereby incorporated by reference.

The operations of the Hydrogen polarization reactor **10** are as follows. A vacuum of up to −30 psi is pulled out of vessel **20** via a commercially available vacuum pump connected to said vessel **20** via tube **50** and valve **51** while being sure that valve **52** of existing pipe **33** is closed. Following the achievement of said vacuum, the vacuum pump is halted and valve **51** closed. Then, the pressure regulator **27** of Hydrogen tank **35** is set to 100 psi and Hydrogen is allowed to fill up vessel **20** at 100 psi. Valve **51** is open to flush the interior gas in order to make sure that vessel **20** contains no atmospheric or other gases. During this flushing, the Hydrogen existing from pipe **50** and valve **51** is capture to prevent its release in the atmosphere for evident environmental reason and disposed of either for re-use or via governmental approved regulations. Following these preparatory steps, with vessel **20** filled up with Hydrogen, the electric arc in gap **4** is activated by automatic means not shown in the figures but such is disclosed in U.S. Pat. No. 8,236,150 which has been incorporated by reference. Following the activation of the electric arc, valve **52** is automatically open and Hydrogen is allowed to pass through said arc and exit through pipe **33** for its passage to the rest of the HyFuels production plant described below.

A main outcome of the above Hydrogen polarization reactor is that of turning a conventional Hydrogen with molecular structure H2=H—H into a magnecular species MH as depicted, for instance, in FIG. **16** showing a clear magnecular structure composed by a mixture of molecular and magnetically bonds such as: MH2=(H—H, H×H), MH3=(H—H×H, H×H×H), MH4=(H—H×H—H, H—H× H×H, H×H×H×H), etc. Carbon electrodes are selected in the preferred embodiment depicted above because of their low costs as well as resistance to high temperature. It should be noted that said carbon electrodes consume during the operation of reactor **10** by producing dimers C—H and their composites that are clearly identified in the chemical analysis of FIG. **16**. These Hydrocarbons HC are admitted by this invention because they are combustible and mostly having a magnetically structure particularly for higher value of atomic mass unit, which means that their combustion is of the novel magnecular type thus being more efficient than that of molecular type as described above.

A variety of 300 kW power units are anticipated for use in the preferred embodiment depicted above, including but not limiting to: steady DC power; DC power with arc pulsing at the rate of at least 100 discharges per seconds (100 Hz) so as to increase the energy content in Joules of each individual discharge by a factor of at least ten when compared to a steady DC arc; steady AC power at commercially available 60 Hz; AC power with increased frequency up to the maximum commercially available at this writing of the order of 150,000 Hz with the capability to vary said frequency in such a way to select a frequency which is a sub harmonic of the resonating frequency of the Hydrogen molecule H2=H—H in which case there is an increase of at least five fold in the efficiency of reactor **10** in the separation of the Hydrogen molecule as typical of all resonating effects. It should be recalled that the separation of the H2 molecule is a necessary pre-requisite for the creation of the new species MH. The above power units can be used either individually or collectively and can be complemented with a variety of additional power assistance means, such as microwave source not shown in the drawings because commercially available and described in details by preceding patents granted to the inventor.

Maintenance of the Hydrogen polarization realtor **10** requires its disassembling at least once per week, checking out conditions of seals **36** or replace them to assume lack of leakage of Hydrogen in the environment; checking out or replacing the electrodes **1** and **2**, and cleaning the interior of vessel **20** from carbon powder that are usually deposited in the interior of vessel **20** as a result of the consumption of the electrodes under the action of the electric arc. In the event a continuous 24 hour use is desired indefinitely without interruptions, reactor **10** should be duplicated with automatic means for releasing polarized Hydrogen into line **14** from one reactor to the other.

With reference to FIG. **37**, the liquid fuel polarization reactor **11** comprises: a horizontally placed vessel **100** consistent of a schedule **40** carbon steel pipe of 2 feet in OD and 7 feet in length completed with welded on hallow flanges at each end as shown in the figure as well as plain flanges **101** and **102** fastened to said hollow flanges in such a way to allow the maintaining of pressure (e.g. 100 psi) in its interior; said vessel **100** containing in its interior the anode-cathode assembly of FIGS. **36**a and **36**b, including hollow anode **1**, plain cathode **2**, gap **4**, respective copper holders **8** and **9**, respective phenolic bushings **26** and **30**, copper hollow tube **24** and copper rod **29** in such a fashion to allow electrical connections to the respective negative polarity **6** and positive polarity **7** of the power unit; said horizontally placed vessel **100** comprising in its lower portion a welded on funnel **103** which is connected to the lower parts of the reactor via bolted on hollow flanges **104** and **105** as shown in the figure; said lower part of the reactor comprising vessel **106** consisting of vertically placed a carbon steel tube of 3 feet in diameter and 5 feet in height completed at the top and bottom ends by welded on hollow flanges as shown in FIG. **38**, plus bolted on plain flanges **107** in the top and **108** at the bottom fastened to said hollow flanges in such a way to allow the maintaining of, for example, 100 psi internal pressure; the interior of vessel **106** comprising basket **109** constructed from, for example, perforated ⅟₁₆" thick steel with ⅟₁₆" holes having the dimensions of 2.5 feet OD and 4 feet in height which basked is connected to the top flange **107** via hooks **110**; the lower vessel **106** being filled up with the desired liquid fuel up to level **114** which is approximately half of the height of vessel **106**; said liquid fuel being circulated through copper tube **24** via pump **117** transferring said liquid fuel from vessel **106** through pipe **115** and then pumping said liquid fuel through copper tube **24** via pipe **118**. The liquid fuel circulation is completed by secondary pipe **121**, flowing the liquid fuels through gap **4** of the electrodes via funnel **123**. The initial

filling of reactor **11** is done via pipe **111** connected to an external tank of said liquid field (not shown). The process of filling is performed by a pump **112** discharging the liquid fuel into vessel **106** as shown. The reactor **11** is completed by a sensor **150** for the measuring of the level of the liquid fuel in vessel **106** by way of, for example, microwaves or other mechanisms. Automatic control of the electric arc, automatic refill of the liquid fuel so as to maintain a constant level, and various other peripheral equipment are not shown in FIG. **37**, such are disclosed in U.S. Pat. No. 8,236,150.

The operation of reactor **11** for the polarization of a conventional liquid fuel is as follows: vessel **106** is filled with the selected liquid fuel through the input pipe **111** from an outside tank of said fuel by a pump **112** with a valve **113** set in an open position and valves **125** and **151** set in closed positions. The filling is stopped by automatic controls when a maximal allowed level is achieved. The input pipe **111**, pump **112** and valve **113** are later used for subsequent automatic refills. A vacuum is pulled out of the entire reactor down to, for example, minus 30 psi via the use of an industrially available vacuum pump connected to a vacuum pipe **150** with a valve **151** open to remove air from the interior of the reactor. A circulation pump **117** is activated, for example, for about one minute to circulate the liquid fuel through the gap **4** between the electrodes **1/2** as well as through funnel **123**; the electric arc is then activated in between electrode **1** and electrode **2**, thereby polarizing said liquid fuel and jointly producing a gaseous fuel as well as carbon deposited often referred to as fullerenes. The gaseous fuel is produced until the internal pressure of reactor **11** is of about, for example, 100 psi at which point reactor **11** enters into the mode of automatic operation I which the automatic release of the mixture of polarized liquid fuel and gas produced by the reactor through effluent line **124** with a valve **125** automatically open. The automatic refill of the conventional liquid fuel occurs through the input pipe **111** and the valve **113** in an open position. The gap **4** between electrode **1** and electrode **2** becomes covered by fullerene deposits that are continuously removed by the vertical flow of the liquid fuel through the funnel **123**. The fullerenes are continuously drained through the funnel **103** into the lower vertical vessel **106** and are captured by a basket **109** that is perforated to permit the polarized liquid fuel to drain to the bottom of vessel **106** where it exits through exit tube **124** and a valve **124** that is automatically opened.

Maintenance of reactor **11** is needed on a regular basis. It is anticipated that the reactor needs to be disassembled after about one week of operation to verify that seals are in good condition and to replace the seals when needed, reducing the release of contaminants into the atmosphere as well as to reduce contamination of the interior of the reactor by atmospheric gasses. A lid **107** is removed from vessel **106** and the basket **109** containing the fullerene deposits is removed from vessel **106** and emptied. The fullerene deposits are dried in a commercially available dryer for use in carbon composites and other manufactured goods as known in the industry. After servicing, the reactor **11** is reassembled and the operations are initiated again according to the above description. 24 hour operation is possible by duplicating reactors with channels for flowing of the mixture of polarized liquid fuel and gas produced by the arc into a tube **15** from the disabled reactor to the operating reactor.

With reference to FIG. **38**, the mixing system **18** of the production plant of FIG. **35** is shown. Polarized Hydrogen originating from reactor **10** of FIG. **36a** enters the mixing system **18** through a pipe **14** and a valve **16**. Polarized liquid fuel from reactor **11** of FIG. **37** enters the mixing system **18**

through a pipe **15** and a valve **17**. The mixture of polarized liquid fuel and gas produced by the arc in reactor **11** flow through the pipe **15** mixing with the polarized hydrogen flowing through the pipe **14**, converging into the single pipe **220**. The resulting mixture of gaseous polarized Hydrogen MH and polarized liquid fuel are compressed at, for example, 5,000 psi by a pressure pump **200** into a high pressure vessel **202** made from, for example, schedule **80** pipe of about 6″ diameter and about 3 feet length. Within the high pressure vessel **202** is a shaft and propellers **203**. The shaft and propellers **203** are rotated by a motor **199** for the continuous mixing of the gaseous and liquid phases while the internal pressure (e.g., 5,000 psi) is maintained by suitable seals **204**. The fluid produced by the apparatus exits vessel **202** through an outlet pipe **206** controlled by a pressure regulator **207** and a check valve **212**, thereby releasing the fluid into a separation tank **230** operating at, for example, around 100 psi, thereby the fluid separates into liquids and gases. The liquids exist through an exit pipe **241** and a control valve **243**. The gases exit the separation tank **230** through an exit pipe **240** and a control valve **242**. It is anticipated that the gases be used, for example, in the gaseous phase (see above), or as a gaseous fuel. In some embodiments, a safety release vent **208** is provided with a pressure relief valve **209**.

The operation of the pressure vessel **202** is shown in FIG. **38**. By closing the valves **16/17/242/243** and opening the valves **251/207** open, a vacuum down to minus 30 psi is pulled out of the entire apparatus by a vacuum pump connected to line **250**. This is done to remove all or most of the air. Next, two valves **16/17** are opened, allowing the mixture of polarized Hydrogen and liquid fuel to enter the high pressure vessel **202** at, for example, 100 psi as monitored by a pressure gauge **211** connected by a tube **210**. The compressor **200** is activated until the pressure within the high pressure vessel **202** is at the desired pressure, for example 5,000 psi, as monitored by a second pressure gauge **201**. The downstream pressure regulator **212** is set to release the effluent fluid at 100 psi. The motor **206** is activated to mix the gaseous and liquid materials that are now within the high pressure vessel **202** at which point two valves **242/243** are opened to maintain 5,000 psi pressure inside the high pressure vessel **202**. The synthesized Fuel exits the plant from the exit pipe **241** for collection and use while the residual gas exits from the exit pipe **240** for use as described previously.

Maintenance of the apparatus of FIG. **38** includes disassembly, for example, once per week to verify that all seals are in proper order and, if not, the seals are replaced to reduce any release of contaminants into the atmosphere. Regular cleaning procedures, such as the removal of possible internal carbon deposits, are also performed.

Numerous alternatives exist over the preceding preferred embodiment. As one illustration among several, the HyFuel production plant can be based on the use of MagneHydrogen MH separated from MagneGas MG, thus requiring no additional polarization. In this case, the production plant of FIG. **35** is essentially reduced to reactor **11** and final station **18** with MH being moved into the latter by the pipe **14**.

The separation of MH from MG is done by the use of industrially available equipment such as Pressure Swing Adsorption PSA, Vacuum Swing Adsorption VSA, Molecular Seeving MG and other equipment that are not shown.

Yet another alternative to the above preferred embodiments is given by the use of MagneGas MG in lieu of MH as the additive gaseous phase released into the pipe **14**. This alternative has industrial utility because MG is internally

rich in magnecularly bonded Hydrogen as well as Oxygen whose latter presence in the produced HyFuel can only be beneficial for utility and the environment. Apparatus for the production of MagneGas is known in the art.

Yet an additional embodiment of this invention is characterized by the use of MagneOxygen MO as an additive to the enrich HyFuels. Being magnecularly bonded, the Oxygen in MO is not free, thus being safe when used in percentage below the stoichiometric ratio for the combustion of Oxygen and HyFuels. In fact, the presence of magnecularly bonded Oxygen in HyFuels increases its combustion, thus decreasing the contaminants in the exhaust while increasing energy output, thus having clear utility.

Oxygen rich HyFuels can be produced by the plant of FIG. 35 in which reactor 10 is used for the polarization of commercially available Oxygen O_2. Alternatively, MO can be obtained via its separation from MG via the use of PSA, VSA, MS or other commercially available equipment. In the latter case, reactor 10 is bypassed and MO is directly released into pipe 14 of FIG. 38.

A preferred embodiment of the industrial production of solid HyFuels, such as Hy-Coal but not restricted to the latter, is essentially that of FIG. 38 in which: the solid fuel (e.g. coal) is reduced to a powdery form and it is processed for the removal of Sulfur and other contaminants via commercially available equipment (not shown) as known by those skilled in the art. The treated solid fuel is then released into the input line 15 and mixed with MH via inlets 14/15 at, for example, 100 psi as monitored by the pressure gauge 211. The mixture is passed through compressor 200 to increase the pressure of the mixture to, for example, 5,000 psi. The mixture under pressure is passed to the high pressure vessel 202 with the second pressure regulator 212 set to 100 psi as described above. The propellers 204 are rotated, facilitating the mixture of the powdery fuel with MH and the resulting mixture is then transferred to the separation tank 230 for the separation of the solid HyFuels from the residual MH in the related exit tubes 240 and 241. The solid, Hydrogen rich HyFuels is collected while the residual MH is collected for re-use or other uses.

Yet additional preferred embodiments of this invention for the case of solid HyFuels are given by the use of MagneOxygen MO or MagneGas MG as additive to powdery solid fuel due to their utility indicated earlier.

Yet an additional preferred embodiment for the production of solid HyFuels is as follows. According to a chemical law established in the early part of the 20th century, all gaseous fuels can be converted into a liquid form via their exposure at pressure of about 240 psi to suitable catalysts, via a process known as the Fisher-Tropsch Catalytic Liquefaction. As an illustration, Natural Gas is converted to Liquid Petroleum LP via said Fisher-Tropsch catalytic tower and said LP remains in the liquid state provided that it is contained in a vessel capable of sustaining its vapor pressure of about 100 psi. This process also applies to MagneHydrogen MH and MagneGas MG resulting in new combustible liquid fuels called, MagneLiquids ML, due to the predominance of the magnecular structure of the liquid state.

The additional preferred embodiment under consideration for the industrial production of solid HyFuels is essentially that of FIG. 39 in which the solid fuel fed into the plant via the feeding tube 15, while releasing into the exit line 14 a selected ML, rather than MH, the two liquids are mixed in intermediate tube 220 and the operation of the reactor of FIG. 38 are continued as per the operation described for the gaseous additive.

The utility of the embodiment using ML additive over the embodiment using MH or MG or MO as additive is the achievement of a greater percentage of additive magnetically bonded to the solid fuel. This is evidently due to the fact that in the transition from a gaseous to a liquid state, there is the increase of the density of at least by a factor of 1,000. Additional increases of utility are due to capillary and other effects present in the liquid but not so defined in the gaseous state.

Yet an additional use of the apparatus of this invention is that of the industrial production of MagneGases via the use of conventional gases and their polarization and mixture via the plant of FIG. 35. As an illustration, two reactors 10 can be used to induce a magnecular structure in H_2 and, separately in CO. The two magnetically polarized gases are then mixed by the apparatus of FIG. 38, and the final effluent gas out of the exit pipe 240 is a combustible gas essentially equivalent to MagneGas as produced via the gasification of liquid waste. This is due to having a chemical structure of the type presented in FIG. 19. This process has utility because the individual atoms are weakly bonded, thus having the magnecular combustion identified above, with increasing the flame temperature as per FIG. 25. Essentially the same method and apparatus are applicable to other forms of fuels, both gaseous, such as O_2, CH_4, etc., as well as liquid, such as gasoline, diesel and propane.

A yet additional application of the apparatus presented herein is given by a novel type of protective coating also based on the anomalous adhesion of polarized gases to substances. An illustrative, but not limiting example is given by the protective coating of computer chips with several layers of Nitrogen atoms that evidently prevent oxidation. For this purpose, conventional pure Nitrogen N_2 can be magnetically polarized via reactor 10 of FIGS. 36A and 36B, the sole difference being the replacement of carbon electrodes with temperature resistant conducting and non-consumable electrodes such as tungsten electrodes. Such electrodes do not contaminate the original gas. The computer chips can then be exposed to the intense magnetic fields generated by solenoids. The so polarized nitrogen and computer chips are then combined via an equipment of the type of FIG. 38 described above. Exposure of the polarized computer chips to the polarized nitrogen at, for example, 5,000 psi, results in the coating of the chips with layers of polarized Nitrogen, such as those of FIGS. 12 to 18. The resulting mixture of coated chips and residual polarized nitrogen is then brought to low pressure tank 230 for the separation of the coated chips from the residual polarized nitrogen via respective exit lines 241/240. The coated chips are collected for further processing, while the residual polarized nitrogen is collected for sale or re-use.

The specific embodiment constructed out of available, high pressure pipes, seals, flanges, etc., is shown as an example of an operational system of the present invention and is not intended to limit this disclosure in any way.

Equivalent elements can be substituted for the ones set forth above such that they perform in substantially the same manner in substantially the same way for achieving substantially the same result.

It is believed that the system and method as described and many of its attendant advantages will be understood by the foregoing description. It is also believed that it will be apparent that various changes may be made in the form, construction and arrangement of the components thereof without departing from the scope and spirit of the invention or without sacrificing all of its material advantages. The form herein before described being merely exemplary and

explanatory embodiment thereof. It is the intention of the following claims to encompass and include such changes.

What is claimed is:

1. An apparatus for creating a bond between a gas and a substance, the apparatus comprising:

a first pressure vessel containing in its interior at least one set of electrodes, means for creating an electric arc between said electrodes, means for passing a gas through the electric arc thereby creating a treated gas, means for controlling said electric arc, and means for collecting said treated gas;

a second pressure vessel containing means for exposing a substance to a magnetic field, thereby forming a polarized substance; and

a third vessel fluidly coupled to the first pressure vessel and the second pressure vessel, the third vessel adapted to receive the treated gas and the polarized substance and the third vessel adapted to expose the received treated gas and the received polarized substance to a high pressure after the substance is exposed to the magnetic field;

wherein the treated gas is conducted into the polarized substance within the third vessel, thereby producing a treated substance.

2. The apparatus of claim **1**, wherein said gas is hydrogen.

3. The apparatus of claim **1**, wherein said substance is gasoline.

4. The apparatus of claim **1**, wherein said substance is diesel.

5. The apparatus of claim **1**, wherein said substance is coal.

6. The apparatus of claim **1**, wherein said gas is nitrogen.

7. The apparatus of claim **1**, wherein said substance is a computer chip.

8. The apparatus of claim **1**, wherein said high pressure is approximately 5,000 pounds per square inch.

9. An apparatus for creating a bond between a gas and a liquid, the apparatus comprising:

a first pressure vessel adapted to contain in its interior a gas and an electric arc between a pair of electrodes, whereas the gas is exposed to the electric arc thereby forming a polarized gas;

a second vessel containing means for exposing a liquid to a magnetic field, thereby forming a polarized liquid; and

a third vessel fluidly coupled to the first pressure vessel and the second vessel, the third vessel adapted to receive the polarized gas and the polarized liquid, the third vessel adapted to combine the received polarized gas and the received polarized liquid and to expose the received polarized gas and the received polarized liquid to a high pressure after the gas is exposed to the electric arc and after the liquid is exposed to the magnetic field;

wherein the polarized gas is conducted into the polarized liquid within the third vessel, thereby producing a synthesized fuel.

10. The apparatus of claim **9**, wherein said gas is hydrogen.

11. The apparatus of claim **10**, wherein said liquid is selected from the group consisting of gasoline and diesel.

12. The apparatus of claim **9**, wherein said high pressure is approximately 5,000 pounds per square inch.

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