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(54) **BLOCKCHAIN MINE AT OIL OR GAS FACILITY**

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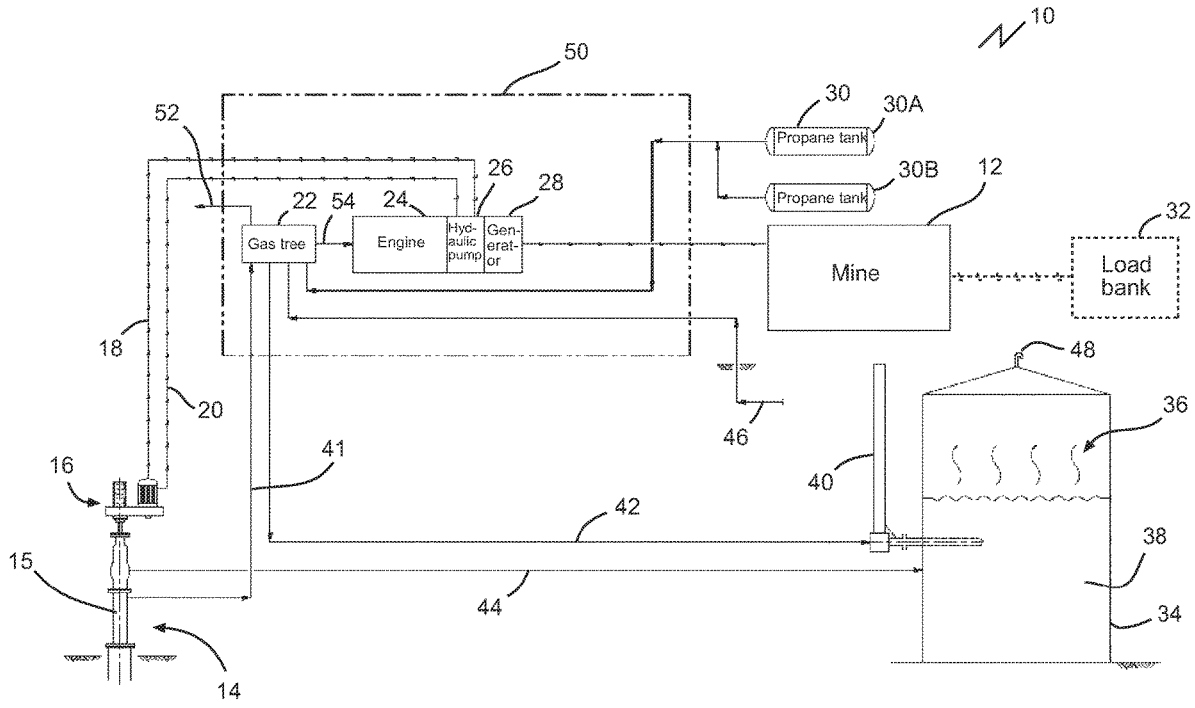
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(57) **ABSTRACT**

Methods and systems of operating a blockchain mining device using natural gas produced at a hydrocarbon production, storage, or processing site/facility. A generator may be retrofitted to an existing prime mover used to pump the well, and the generator may be used to power the blockchain mining device. Portable mining devices may be hooked up to a casinghead gas supply at a remote, isolated oil facility. Power loading levels may be modulated by adjusting mining transaction levels to correspond with combustible gas production levels.



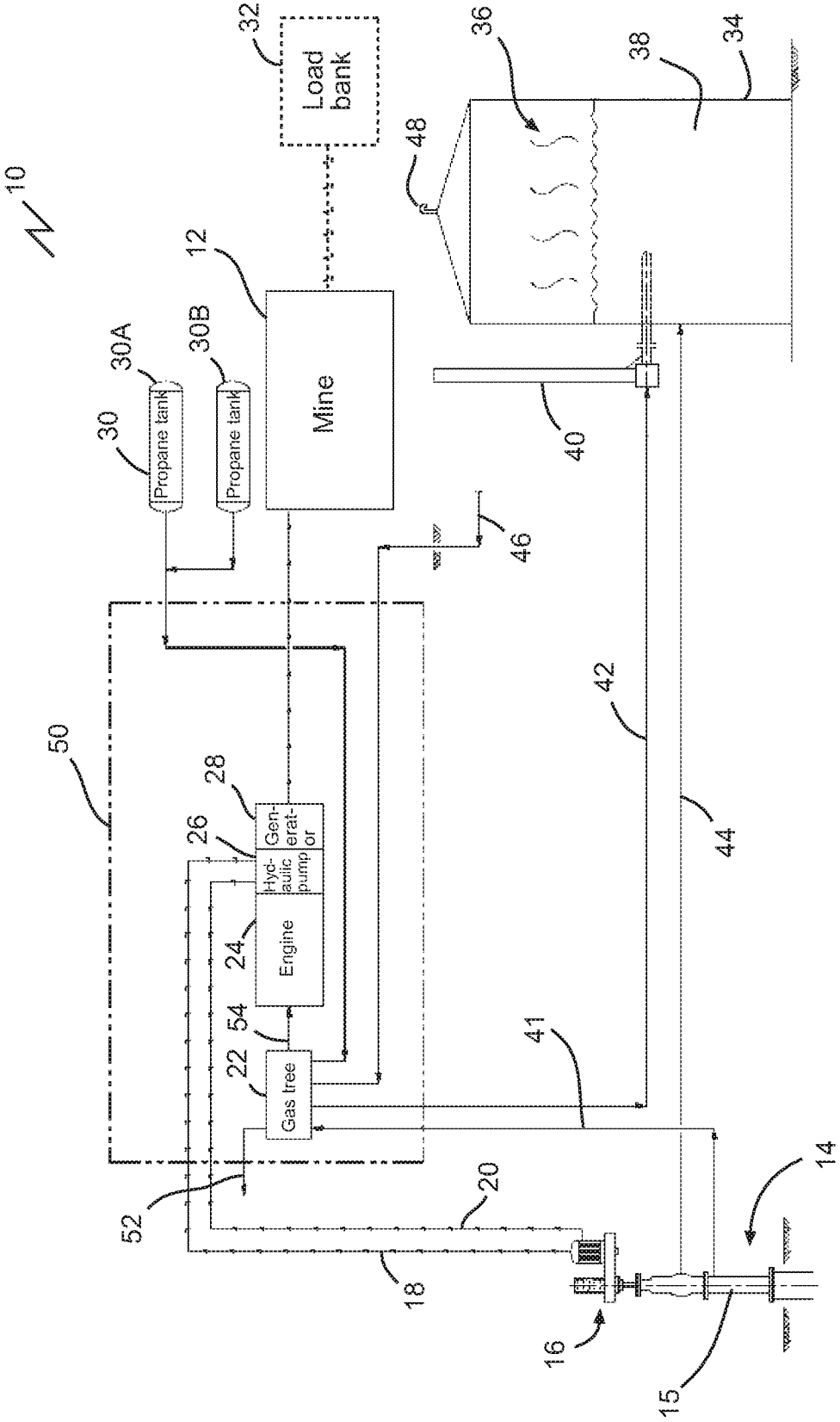

10
12
Mine
30
30A
Propane tank
30B
Propane tank
32
Load bank
34
36
38
40
41
42
44
46
48
50
52
14
15
16
18
20
22
Gas tree
24
Engine
26
Hyd-aulic pump
28
Gen-erat-or
54

Fig. 1

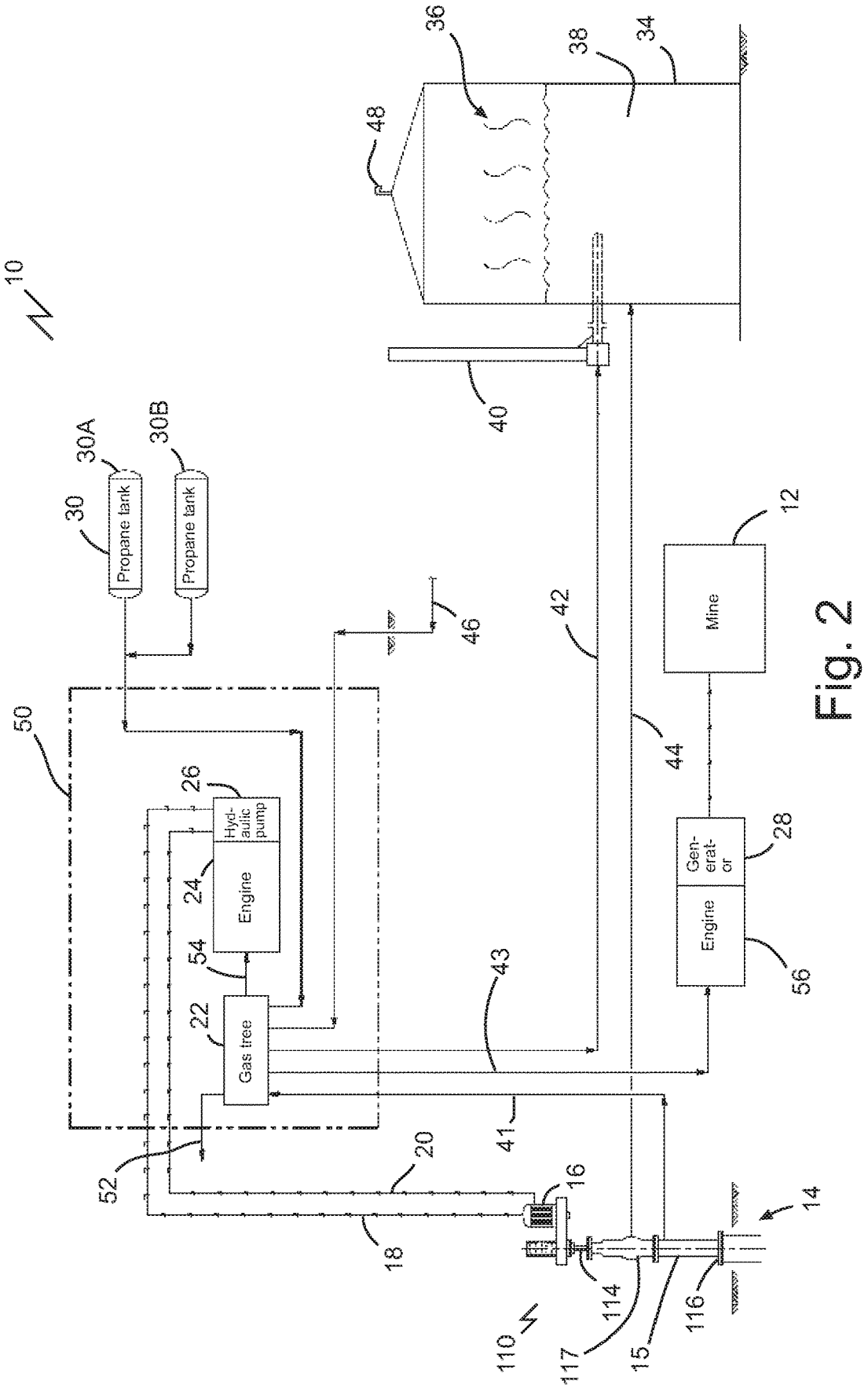

10
36
38
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48
40
30A
30B
30
Propane tank
Propane tank
46
42
12
Mine
50
44
26
Hyd-
aulic
pump
24
Engine
54
43
28
Gen-
erat-
or
Engine
56
22
Gas tree
52
20
41
16
14
18
110
114
117
15
116

Fig. 2

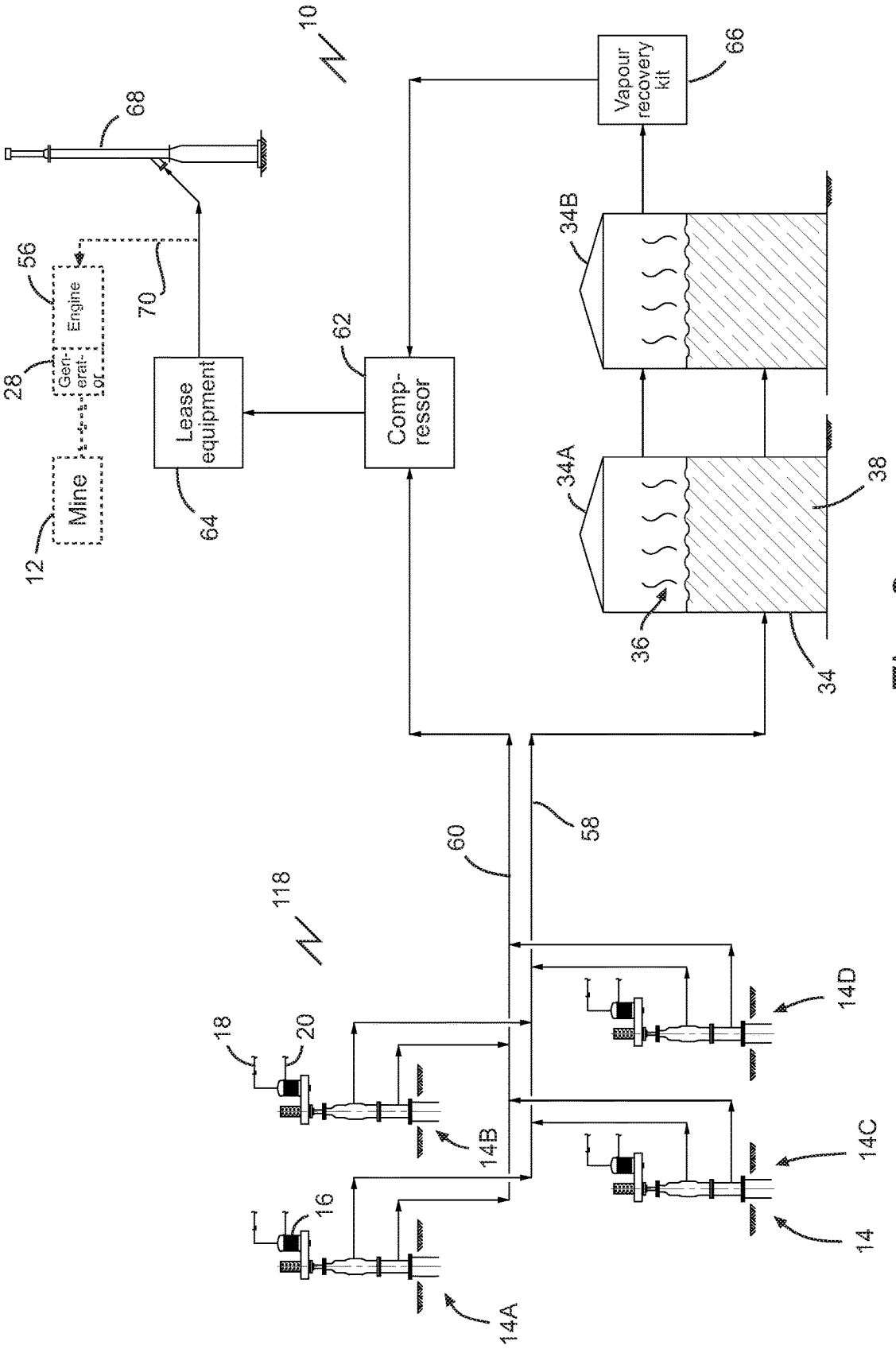

10
Vapour recovery kit
66
68
56
Engine
Gen-erat-or
28
70
62
Comp-ressor
Lease equipment
64
Mine
12
34B
34A
38
36
34
118
60
58
18
20
14B
14D
16
14C
14A
14

Fig. 3

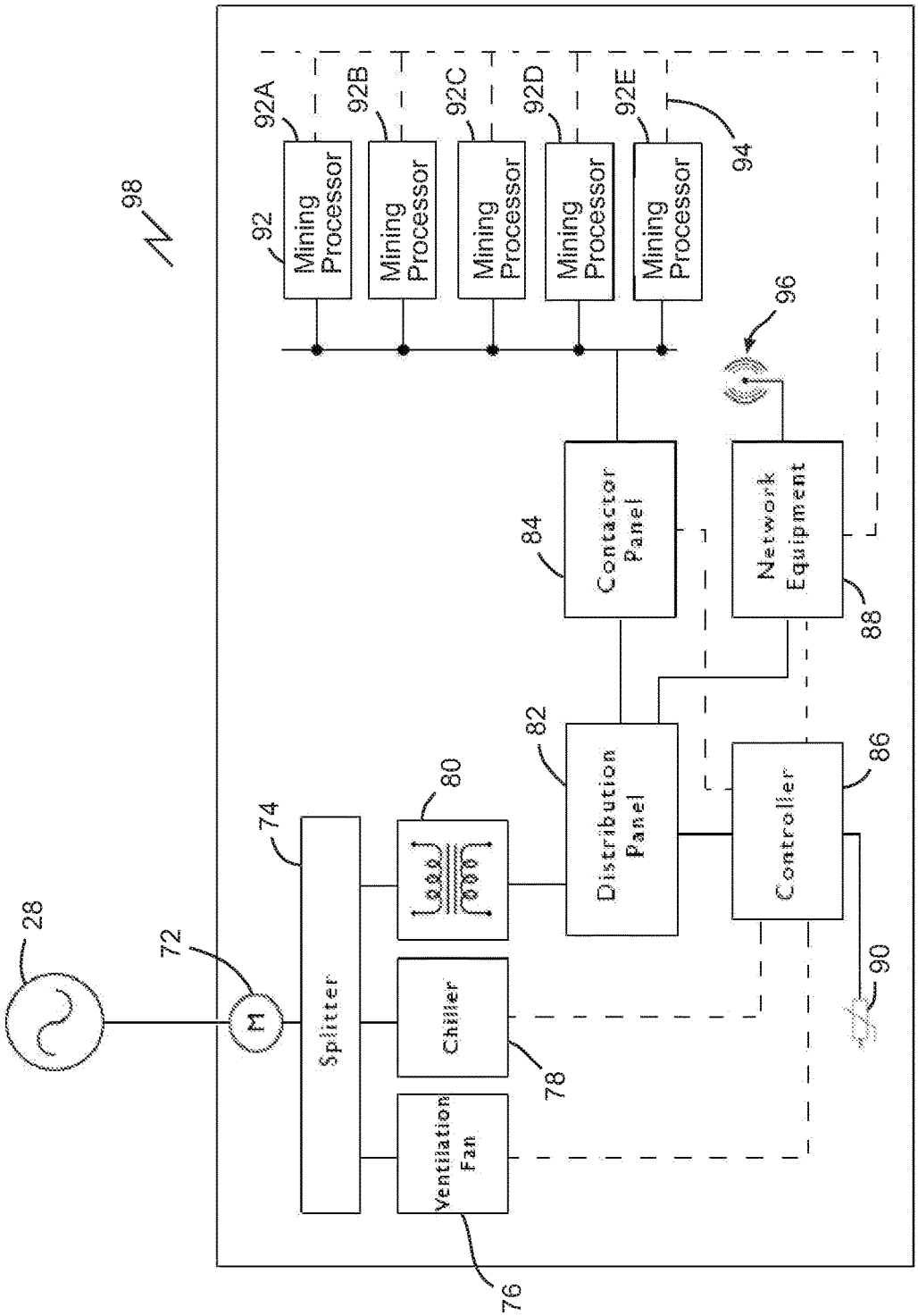
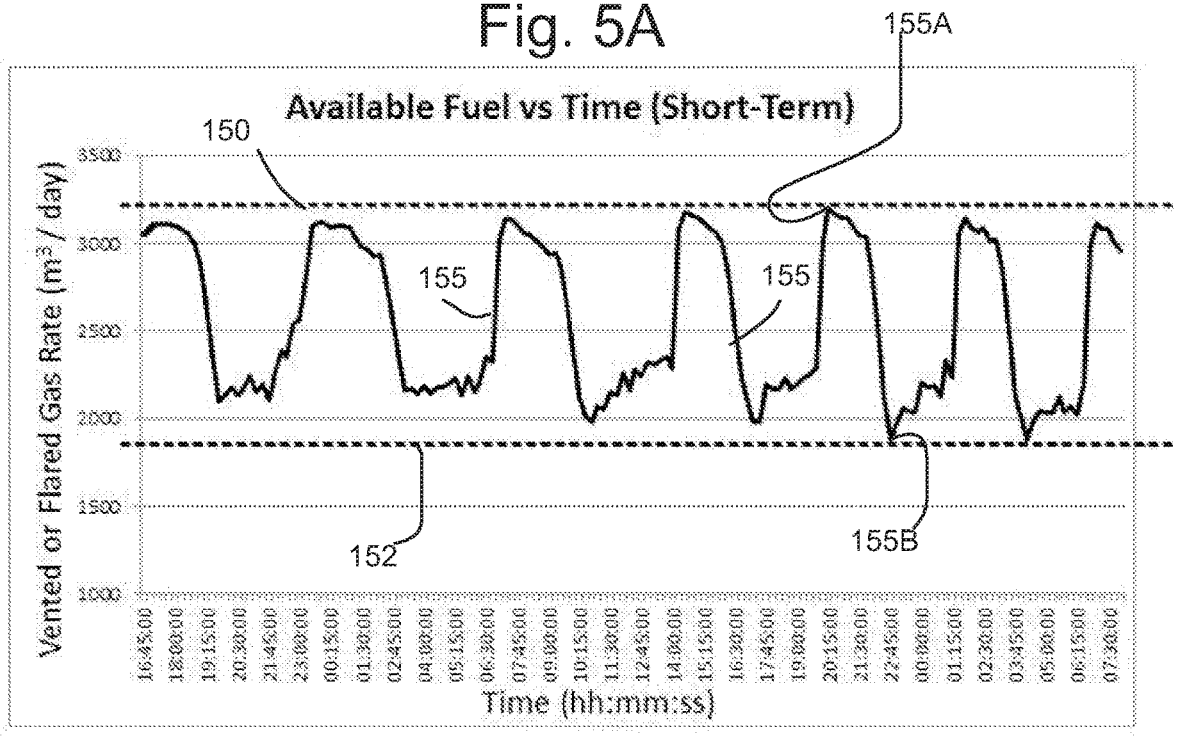

98
92
92A
92B
92C
92D
92E
94
Mining Processor
Mining Processor
Mining Processor
Mining Processor
Mining Processor
96
84
Contactor Panel
Network Equipment
88
82
Distribution Panel
Controller
86
80
74
Splitter
Chiller
Ventilation Fan
78
76
72
M
28
90

Fig. 4

Fig. 5A


Available Fuel vs Time (Short-Term)
150
155A
155
155
152
155B
Vented or Flared Gas Rate (m³ / day)
3500
3000
2500
2000
1500
1000
16:45:00
18:00:00
19:15:00
20:30:00
21:45:00
23:00:00
00:15:00
01:30:00
02:45:00
04:00:00
05:15:00
06:30:00
07:45:00
09:00:00
10:15:00
11:30:00
12:45:00
14:00:00
15:15:00
16:30:00
17:45:00
19:00:00
20:15:00
21:30:00
22:45:00
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07:30:00
Time (hh:mm:ss)

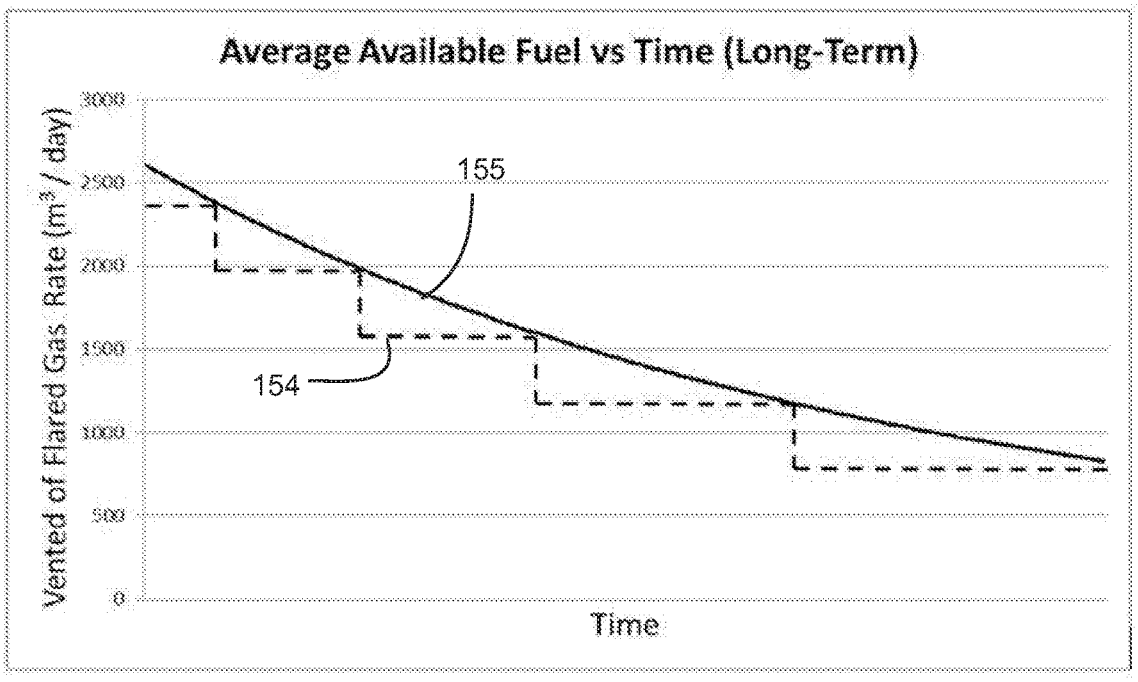

Average Available Fuel vs Time (Long-Term)
Vented of Flared Gas Rate (m³ / day)
3000
2500
2000
1500
1000
500
0
155
154
Time

Fig. 5B

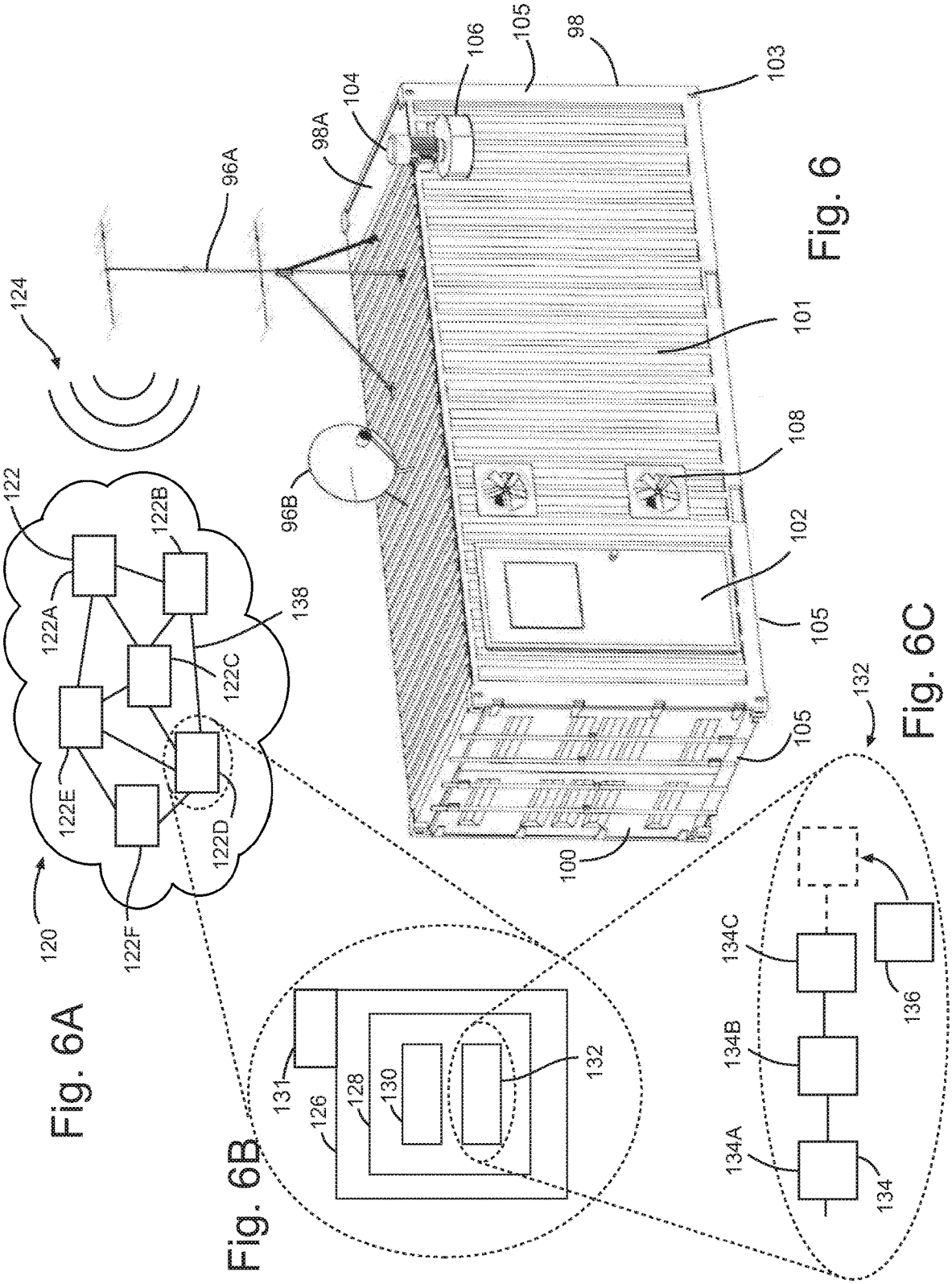


Fig. 6

Fig. 6A

Fig. 6B

Fig. 6C

BLOCKCHAIN MINE AT OIL OR GAS FACILITY

TECHNICAL FIELD

[0001] This document relates to blockchain mining at an oil or gas facility.

BACKGROUND

[0002] At remote oil and gas facilities, excess natural gas is often wasted, for example vented to atmosphere or burned via flaring.

SUMMARY

[0003] A system is disclosed comprising: a source of combustible gas produced from an oil production, storage, or processing facility, such as a remote oil well; a generator connected to the source of combustible gas; and a blockchain mining device connected to the generator.

[0004] A method is disclosed comprising using a source of combustible gas produced at a hydrocarbon production well, storage, or processing facility, to produce electricity to operate a blockchain mining device located at the hydrocarbon production well, storage, or processing facility, respectively.

[0005] A method is disclosed comprising using a source of combustible gas, which is produced from a remote oil or gas well, to produce electricity to operate a blockchain mining device.

[0006] A method is disclosed comprising: disconnecting a source of combustible gas from a gas vent or combustion device at a hydrocarbon production well or processing facility; and connecting the source of combustible gas to produce electricity to operate a blockchain mining device.

[0007] A method is disclosed comprising using a source of combustible gas, which is produced from a remote oil or gas well, to produce electricity to operate a blockchain mining device.

[0008] A method is disclosed of reducing vented or flared natural gas at upstream oil and gas facilities, the method consists of operating a natural gas aspirated prime mover fueled directly by the vented or flared gas source; the prime mover runs a generator to generate power, the generator powers a portable blockchain mine.

[0009] An upstream oil and gas blockchain mining apparatus is disclosed comprising a well, excess gas is captured off the casing of the well to run a natural gas engine, the engine runs both a hydraulic pump and a generator, the generator powers a portable blockchain mine, where the mining load is sized at the low end of the variable availability of gas; excess gas above the amount required to fuel the load is vented, where the mining load is sized at the low end of the variable availability of gas; the prime mover varies its torque based on the availability of the gas so as to minimize excess vented gas, excess power above the amount necessary to run the mining load is dissipated in a load bank, where the mining load is sized at the high end of the variable availability of gas; and make-up gas is taken from propane tanks on site or from line gas.

[0010] An upstream oil and gas blockchain mining apparatus is disclosed comprising a well, excess gas is captured off the casing of the well to run a prime mover such as an engine, turbine or boiler, the prime mover runs a generator, the generator powers a portable blockchain mine, where the mining load is sized at the low end of the variable availability of gas; excess gas above the amount required to fuel the load is vented, where the mining load is sized at the low end of the variable availability of gas; the prime mover varies its torque based on the availability of the gas so as to minimize excess vented gas, excess power above the amount necessary to run the mining load is dissipated in a load bank, where the mining load is sized at the high end of the variable availability of gas; make-up gas is taken from propane tanks on site or from line gas.

[0011] An upstream oil and gas blockchain mining apparatus is disclosed comprising a multi-well pad or group of satellite wells that produce into an oil treating facility, gas is captured off of the casing of the wells or off of oil and gas separating vessels such as tanks at the treating facility via vapor recovery units or compressors, the gas is used to run a prime mover such as an engine or turbine, the prime mover runs a generator which powers a portable blockchain mine.

[0012] An upstream oil and gas blockchain mining apparatus is disclosed comprising an oil and gas treating facility consists of a flare, incinerator, combustor or burner; excess gas is taken off the inlet line of the flare and redirected to a prime mover such as a natural gas engine, turbine or boiler, the prime mover runs a generator which powers a portable blockchain mining device.

[0013] A portable blockchain mining apparatus is disclosed comprising an enclosure containing the blockchain mining equipment, the enclosure having a ventilation mechanism, to dissipate the heat produced by the mining processors, for example one or more of an air supply fan, an exhaust fan, louvers, and others, the enclosure having a satellite, radio or cellular antenna to provide a connection to the internet, the enclosure containing network equipment such as a modem and network switch, the enclosure designed to be portable such as trailer mounted, the enclosure being insulated from the elements, the enclosure containing a natural gas aspirated engine and a generator to power the mining equipment, and the engine may comprise a turbine, where the enclosure is an intermodal shipping container, where the enclosure has a chiller or air cooling means fitted to it, the enclosure having a back-up heating means, such as a space heater, to be used to pre-heat the enclosure in case of shut down in cold weather.

[0014] In various embodiments, there may be included any one or more of the following features: The oil production, storage, or processing facility comprises a remote oil well. The oil production, storage, or processing facility comprise an oil storage or processing unit. The system is isolated from a sales gas line and an external electrical power grid. The source of combustible gas comprises the remote oil well; and the remote oil well is connected to produce a continuous flow of combustible gas to power the generator. A combustion engine is connected to the source of combustible gas and connected to drive the generator. The combustion engine is a prime mover that is connected to produce oil from the remote oil well. The combustion engine is a first combustion engine, and further comprising a second combustion engine that is a prime mover that is connected to produce oil from the remote oil well. The source of combustible gas comprises an oil storage or processing unit with a gas outlet connected to supply combustible gas to operate the generator; and the oil storage or processing unit is connected to receive oil produced from a remote oil well. The generator and blockchain mining device are located

adjacent to the oil production, storage, or processing facility, for example adjacent to the remote oil well. The remote oil well comprises a plurality of remote oil wells, and one or both of the following conditions are satisfied: the plurality of remote oil wells are located on a multi-well pad; or the plurality of remote oil wells include a satellite well. The blockchain mining device has a network interface and a mining processor; the network interface is connected to receive and transmit data through the internet to a network that stores or has access to a blockchain database; and the mining processor is connected to the network interface and adapted to mine transactions into blocks associated with the blockchain database and to communicate with the blockchain database. The network is a peer to peer network; the blockchain database is a distributed database stored on plural nodes in the peer to peer network; and the blockchain database stores transactional information for a digital currency. A controller is connected to modulate a power load level exerted by the blockchain mining device on the generator, by increasing or decreasing the mining activity of the mining processor. The mining processor comprises a plurality of mining processors; and the controller is connected to modulate the maximum power load level by increasing or decreasing a maximum number of mining processors that are engaged in mining. The source of combustible gas comprises the remote oil well, which is connected to produce a continuous flow of combustible gas to operate the generator. The controller is connected to modulate the power load level in response to variations in a production rate of combustible gas from the remote oil well. A production rate of combustible gas from the remote oil well varies between a daily minimum production rate and a daily maximum production rate; and while the production rate is above the daily minimum production rate, the controller is set to limit the power load level to at or below a power level producible by the generator when the production rate is at the daily minimum production rate. The controller is set to divert to a load bank excess electricity produced by the generator. A production rate of combustible gas from the remote oil well varies between a daily minimum production rate and a daily maximum production rate; the controller is set to limit the power load level to above a power level producible by the generator when the production rate is at the daily minimum production rate; and a backup source, of fuel or electricity, is connected make up a shortfall in fuel or electricity, respectively, required to supply the blockchain mining device with the power load level. A controller is connected to operate a ventilation, heating and cooling system to maintain the blockchain mining device within a predetermined operating range of temperature. The blockchain mining device is mounted on a skid or trailer. The skid or trailer comprises a generator driven by an engine, which is connected to the source of combustible gas. The engine comprises a turbine. The generator and engine may be mounted integral to the skid, trailer, or blockchain mining device. The blockchain mining device comprises an intermodal transport container. Prior to using the source of combustible gas: disconnecting the source of combustible gas from a combustible gas disposal device at the hydrocarbon production well, storage, or processing facility; and connecting the source of combustible gas to operate the blockchain mining device. Connecting the source of combustible gas to operate the blockchain mining device; and diverting gas from a combustible gas disposal or storage device to operate the blockchain mining device. The combustible gas disposal or storage device comprises one or more of a flare, a vent to the atmosphere, an incinerator, or a burner. The hydrocarbon production well, storage, or processing facility comprises an oil or gas well that is isolated from a sales gas line and an external electrical power grid. The source of combustible gas is a remote oil or gas well, and further comprising producing a continuous flow of combustible gas to power a generator connected to operate the blockchain mining device. Producing further comprises supplying combustible gas to a combustion engine that is connected to drive the generator. The source of combustible gas is a remote oil well, and further comprising using the combustion engine as a prime mover to produce oil from the remote oil well. Prior to using the source of combustible gas, the combustion engine is under loaded as the prime mover, and further comprising connecting the generator to a power takeoff connected to the combustion engine. The combustion engine is a first combustion engine, and further comprising: prior to supplying combustible gas to the first combustion engine, connecting the first combustion engine to receive combustible gas from the remote oil well; and using a second combustion engine as a prime mover to produce oil from the remote oil well. Operating the blockchain mining device to: mine transactions with the blockchain mining device, for example by mining the most recent block on the blockchain with the blockchain mining device; and communicate wirelessly through the internet to communicate with a blockchain database. Modulating, using a controller, a power load level exerted by the blockchain mining device on the generator, by increasing or decreasing the mining activity of the blockchain mining device, for example the mining activity of plural mining processors contained within the blockchain mining device. The blockchain mining device comprises a plurality of mining processors; and modulating comprises modulating the power load level by increasing or decreasing a maximum number of mining processors that are engaged in mining. Modulating comprises modulating the power load level in response to variations in a production rate of combustible gas from the remote oil or gas well. A production rate of combustible gas from the remote oil or gas well varies between a daily minimum production rate and a daily maximum production rate; and modulating comprises limiting, while the production rate is above the daily minimum production rate, the power load level to at or below a power level producible by the generator when the production rate is at the daily minimum production rate. One or more of: diverting to a load bank excess electricity produced by the generator; or diverting, to a combustible gas disposal or storage device, excess combustible gas supplied to operate the generator. A production rate of combustible gas from the remote oil or gas well varies between a daily minimum production rate and a daily maximum production rate; and modulating comprises limiting the power load level to above a power level produced by the generator when the production rate is at the daily minimum production rate; and supplying from a backup fuel or electricity source a shortfall in fuel or electricity, respectively, required to supply the blockchain mining device with the power load level. The power load level is limited to above a power level produced by the generator when the production rate is at the daily maximum production rate. The blockchain mining device may be replaced by a suitable mining device or data center. The prime mover is connected to drive a pump jack or a

rotating drive head mounted to the remote oil well. The power unit comprises a generator driven by a power take off from the prime mover. A compressor is connected to pressurize natural gas supplied from the source of natural gas to the power unit. The source of combustible gas comprises raw natural gas. The remote oil well comprises a plurality of remote oil wells. The network interfaces comprises one or more of a satellite, cellular, or radio antenna, connected to a modem. Successfully mining a block by a mining processor provides a reward of the digital currency, and the reward is assigned to a digital wallet or address stored on a computer readable medium. Prior to using the source of combustible gas, disconnecting the source of combustible gas from a gas vent or combustion device; and connecting the source of combustible gas to operate the blockchain mining device. The source of vented or flared natural gas is derived from combustible vapors produced as a result of oil treating or processing, such as an oil storage tank, separating vessel, or a free water knockout. The source of vented or flared natural gas is sourced from the inlet line of a flare, incinerator, combustor or burner. Retrofitting an existing natural gas engine running a hydraulic pump to also run a generator, the generator powering a portable blockchain mine. Adding secondary prime movers such as natural gas internal combustion engines, turbines or boilers to run associated generators, the generators powering a portable blockchain mine. The mining load is sized at the low end of a variable vented or flared gas supply such that back-up fuel requirement usage is minimized, the excess gas over and about the amount required to fuel the mining load is vented or flared (combusted). The mining load is sized at the low end of a variable vented or flared gas supply such that back-up fuel requirement usage is minimized, the engine is controlled to throttle up or down based on the availability of excess gas so as to produce more torque, the additional torque generates excess power above that required to run the mining load, the excess power is directed to a load bank and dissipated as heat, and thus venting is minimized. The electrical load (of the mining hardware) is sized at the high end of a fluctuating excess or stranded gas supply such that venting or flaring is minimized or eliminated, where shortages in gas supply are made up from available back-up fuel such as propane or line gas. Changing the blockchain mine electrical load over time in response to changes in the excess or stranded gas volume availability. The mining load can be changed through the addition or removal of mining processors. Minimizing the vented or flared gas volumes by changing the mining hardware load in reaction to observed changes in average natural gas source rates over time. Minimizing the consumed back up fuel volumes by changing the mining hardware load in reaction to observed changes in average natural gas source rates over time.

[0015] These and other aspects of the device and method are set out in the claims, which are incorporated here by reference.

BRIEF DESCRIPTION OF THE FIGURES

[0016] Embodiments will now be described with reference to the figures, in which like reference characters denote like elements, by way of example, and in which:

[0017] FIG. **1** is a schematic illustrating a system for powering a blockchain mine at a remote oil well using a generator retrofitted to a prime mover, which operates a drivehead to pump oil up from the reservoir.

[0018] FIG. **2** is a schematic illustrating another embodiment of a system for powering a blockchain mine at a remote oil well, with a prime mover (engine) operating the drivehead, and another engine and generator connected to the remote well for powering the blockchain mine independent of the prime mover that operates the drive head.

[0019] FIG. **3** is a schematic illustrating another embodiment of a system for powering a blockchain mine, in which a generator and engine are connected to be powered by combustible gas taken off of an oil storage unit to power the blockchain main.

[0020] FIG. **4** is a schematic depicting a blockchain mining device with a plurality of mining processors and associated control and network equipment housed within a portable enclosure.

[0021] FIG. **5**A is a graph that illustrates short-term changes in available natural gas produced over time by an oil production, storage, or processing facility.

[0022] FIG. **5**B is a graph that illustrates long-term changes in available natural gas produced over time by an oil production, storage, or processing facility.

[0023] FIG. **6** is a perspective view of an intermodal shipping container housing blockchain mining equipment for use at a remote oil or gas production, storage, or processing facility.

[0024] FIGS. **6**A, **6**B, and **6**C are diagrams that illustrate a) a peer-to-peer network, b) a layout of hardware forming a single node in the peer-to-peer network, and c) a conceptual illustration of a blockchain database stored on an individual node, respectively.

DETAILED DESCRIPTION

[0025] Immaterial modifications may be made to the embodiments described here without departing from what is covered by the claims.

[0026] Natural gas is a naturally occurring combustible gas, often in the form of a mixture of hydrocarbon gases that is highly compressible and expansible. Methane (CH_4) is the chief constituent of most natural gas (constituting as much as 85% of some natural gases), with lesser amounts of ethane, propane, butane, and pentane. Impurities may also be present in large proportions, including carbon dioxide (CO_2), helium, nitrogen, and hydrogen sulfide (H_2S).

[0027] Natural gas may be produced from various sources. Natural gas may naturally separate from the oil stream as it is produced up the well and may be captured off the casing side of the well, the casing side referring to the annular space between the production tubing and the well bore or well casing if present. When natural gas is produced from an underground reservoir, it may be saturated with water vapor and may contain heavy hydrocarbon compounds as well as nonhydrocarbon impurities. Natural gas produced from shale reservoirs is known as shale gas. The composition of the gas stream is a function of the thermal maturity of the rock. Thermally immature rocks will contain heavier hydrocarbon components and may contain liquid components. Overmature reservoirs may contain appreciable quantities of CO_2. Natural gas may also be liberated out of solution from the oil as it is treated, such as in a tank on the well site or as it is undergoes further refinement at a downstream facility. In upstream production of oil and gas, natural gas may be produced as the primary product, for example from a gas well, or as a by-product of oil production, for example from an oil well.

[0028] Natural gas produced as a by-product of oil production may be used in various ways. The oil well operator may attempt to capture the gas and consume it, for example as on-site fuel for equipment or for instrumentation pressure. If there is an excess of natural gas that cannot be used on site, it may be desirable to sell the excess by tying the source into a pipeline network with a sales line to sell to a customer connected to the pipeline network. If the amount of gas is significant, it can be compressed or liquefied into storage vessels to be sold to market. If there is no pipeline network but there is a power grid, the operator may have the option to use the gas to generate electricity to sell to the power grid owner.

[0029] Raw natural gas may require processing before it can be sold via a sales gas line. In long distance transmission of sales gas by pipeline, the pressure is usually less than 1,000 pounds per square inch gage (PSIG). It is important that no liquids form in the line because of condensation of either hydrocarbons or water. Hydrocarbon liquids reduce the pipeline efficiency and might hold up in the line to form liquid slugs, which might damage downstream compression equipment. Condensed water can do the same damage. Additionally, water may form solid complexes (hydrates), which accumulate and block the line. Further, it may be economical to extract liquefiable hydrocarbon components, which would have a higher market value on extraction as compared with their heating value if left in the gas.

[0030] The end user of natural gas needs to be assured of two conditions before committing to the use of gas in a home or factory: the gas must be of consistent quality, meeting sales gas specifications, and the supply of gas must be available at all times at the contracted rate. Gas treating facilities, therefore, must be designed to convert a particular raw gas mixture into a sales gas that meets the sales-gas specifications, and such facilities must operate without interruption. Typical processing steps include inlet separation, compression, gas sweetening, sulfur recovery or acid gas disposal, dehydration, hydrocarbon dewpoint control, fractionation and liquefied petroleum gas (LPG) recovery, and condensate stabilization. Sales gas specifications may vary by jurisdiction, although Table 1 below illustrates a typical specification. A sales gas line may be a pipeline of more than ten km of length, in some cases more than fifty, a hundred, or two hundred, kilometers in length, and connecting between an oil and gas site and travelling to an end user, a processing site, or a distribution site.

TABLE 1

Typical Sales Gas Specification

Component	Sales Gas Specification (maximum limits)
H2S (ppm)	10-16
O2 (mol. %)	0.0
CO2 (mol. %)	2-3
Moisture (mg/L and lb/mmscf)	0.1-.16 (4-10)

[0031] A source of natural gas may be located at a remote oil and gas site, for example one that is lacking in accessible infrastructure such as an external pipeline network (sales line) or external power grid to sell into. In many locations it may not be economically feasible to build the infrastructure required to take the produced gas, or resultant electricity generated by combustion of the gas, to market, for example due to significant capital expense required or when the volume of gas is insufficient to pay out the investment. In such cases, the operator is forced to do something with the excess or stranded gas and is left with few options. Such options currently include venting the gas to atmosphere un-combusted, combusting the gas on site via flare, incinerator, or combustor, or worst case scenario ceasing production of the gas source, for example shutting in the oil well.

[0032] Venting excess gas to atmosphere is the most cost effective option for the operator but may have the most negative impact on the environment, as excess natural gas is regarded as 25-35 times worse than CO_2 as a greenhouse gas on a 100 year global warming potential timescale. Currently, venting gas to atmosphere is a common occurrence in oil production all over the world, as few jurisdictions restrict this practice.

[0033] Combustion disposal options, while more environmentally friendly than venting, represent a significant capital expense and do not provide utility for the operator. Combustion options include, but are not limited to, flaring and incineration. Combustion disposal methods produce waste heat and essentially represent waste of the potential energy of the gas. Such options may represent a capital liability to the operator, as such do not generate any revenue. Both combustion and venting can pose health concerns to nearby residents and are typically considered a nuisance.

[0034] Selling excess gas to a pipeline, i.e. a sales gas line, or using the gas to generate electricity to sell to an external power grid may be ideal options, but such options may require a significant capital expense when there is no infrastructure nearby. To pay off the capital expense, the volume of excess gas must be significant and the supply must also be guaranteed for the payout period. This is often not the case in many upstream oil production activities, as gas volumes associated with oil production can quickly diminish. Many remote oil and gas sites are located in unpopulated areas that are hundreds of kilometers outside of the nearest town, and of which no viable sales option is economically feasible.

[0035] An external power grid may be an electrical power transmission system comprising overhead or underground wiring, often supplying electricity in polyphase form, and spanning an electrical substation to an oil and gas site. Long-distance electricity transmission is typically carried with high voltage conductors. Transmission lines traverse large regions and require numerous support towers, often spanning hundreds of kilometers from generation to distribution and end use. Substations transform power from transmission voltages to distribution voltages, typically ranging from 2400 volts to 37,500 volts.

[0036] Referring to FIGS. **1-3**, a system **10** is illustrated comprising a source of combustible gas, for example natural gas or another hydrocarbon gas, produced from a hydrocarbon production, storage, or processing facility, in this case a remote oil well **14**, a power unit such as a generator **28**, and a blockchain mining device **12**. The generator **28** is connected to produce electricity from the source of natural gas. The data mining or blockchain mining device **12** is connected to the generator **28**, for example connected to receive electricity from or be powered by the generator **28**. Referring to FIG. **2**, an oil well **14** may include a suitable production tree **110**, which may include a drivehead **16**, a stuffing box **114**, a flow tee **117**, and a casinghead **15**, all mounted on a wellhead **116**.

[0037] Referring to FIGS. **1-3**, the remote oil or gas well **14** may be isolated from one or more of a sales gas line or external power grid. Isolated may refer to the fact the no sales gas line or external power grid, as the case may be, is located within a distance that would be economically feasible to connect into, for example such infrastructure may be more than five, ten, fifty, or a hundred kilometers away. Oil and gas production, storage, and processing assets are often distributed across remote locations. For example, well-sites can be remote and isolated from conventional communications equipment making the retrieval of well-site data difficult and unreliable. Some locations can be so remote, that periodic on-site visits are required to manually or semi-manually retrieve data. Some locations are only accessible via off-road vehicles or helicopter.

[0038] Referring to FIGS. **1-2**, the combustible gas used in the systems and methods in this document may be natural gas, such as raw natural gas and/or casing gas. Casing gas, also known as casinghead gas, is gas produced as a byproduct from a producing oil well **14**. Referring to FIG. **1**, casing gas is taken from the well **14** through the casinghead **15** at the top of the well **14**. The casinghead **15** is in fluid communication with the annulus defined between the production tubing and the well bore or well casing lining the well bore. The casinghead may feed raw natural gas via supply line **41** to a gas tree **22**, which may distribute the gas to the various pieces of equipment on site that may use or dispense of the gas. Raw gas may be a gas directly produced from the well, or otherwise unprocessed. Raw gas may contain natural gas liquids (condensate, natural gasoline, and liquefied petroleum gas), water, and some other impurities such as nitrogen, carbon dioxide, hydrogen sulfide and helium.

[0039] Referring to FIGS. **1-3**, the generator **28** and blockchain mining device **12** may be positioned at a suitable location relative to the hydrocarbon well, storage site, or processing facility, such as remote oil well **14**. The generator **28** and blockchain mining device **12** may be located adjacent to the remote oil well **14**, for example within one hundred meters. The generator **28** and blockchain mining device **12** may be located further distances away, for example within one kilometer of the remote oil well **14**. Relatively longer distances may permit the device **12** to be powered by combustion of gas from plural wells **14** as described below.

[0040] Referring to FIGS. **1-2**, as above, system **10** may be located at a remote oil well. In the examples shown, the source of combustible gas comprises the remote oil well, **14**. As the source of gas the remote oil well **14** may be connected to produce a continuous flow of combustible gas to power the generator **28**, for example by supply of combustible gas to a combustion engine **24** that is connected to drive the generator **28**.

[0041] Referring to FIG. **1**, at a remote oil well site an internal combustion engine **24**, such as a motor, may be set up to operate as, or to drive, a prime mover, such as a pump jack or rotating drivehead **16**, which is connected to produce oil from the remote oil well **14**. A prime mover in this document refers to any machine that converts energy from a source energy into mechanical energy, as a motive power source providing energy to move the components that pump oil from the well **14**. A pumpjack converts the rotary motion of a driveshaft of the engine **24** to a vertical reciprocating motion of a walking beam to raise and lower the pump shaft (polished rod) to operate a downhole pump positioned at the base of production tubing in the well. A rotating drivehead **16** is a top side motor that rotates the polished rod to operate a downhole moineau or progressing cavity pump, which in turn drives oil up the production tubing to surface. Driveheads and pumpjacks are examples of artificial lift systems, other examples of which include bottom hole motors. A rotating drivehead may incorporate a hydraulic motor that is driven by a hydraulic pump **26**, which is driven by the prime mover or engine **24**, for example via supply and return hydraulic lines **18** and **20**. At many remote oil wells **12** the prime mover or engine **24** is connected to receive as fuel natural gas from the source of combustible gas, in this case well **14**, for example via gas tree **22** and supply line **54**.

[0042] Referring to FIG. **1**, the prime mover engine **24** may be connected to drive the generator **28**. In one case the generator **28** is connected, in some cases retrofitted, to a power takeoff on the engine **24**, such as a drive shaft. In some cases the drive shaft also operates the hydraulic pump **26**, or drives the gearbox of a pumpjack. The remote oil well **14** may produce natural gas as a by-product off an annulus of the well **14** or other space between adjacent sections of piping, tubing, and/or casing positioned within the well **14**. The generator **28** may be any device that converts mechanical energy to electrical energy, such mechanical energy being converted from energy of combustion of the combustible gas. The engine **24** may be a natural aspirated internal combustion engine. The combination of the generator **28** and the engine **24** may be referred to as a genset or engine-generator. The generator **28** may be an alternator, a gas turbine generator, a boiler coupled with a steam-powered generator, or other suitable devices.

[0043] Referring to FIG. **1**, the generator **28** may be used to leverage excess energy available when the prime mover engine **24** is under loaded. For example, an engine **24** may be rated at **60** or higher horsepower, but may actually only require 20-30 horsepower to pump the well **14**. In such a case the well **14** is a good candidate for retrofitting a generator **28** to leverage the excess power capacity of the engine **24**. The generator **28** may thus be connected, for example through a power takeoff, to the combustion engine **24**. In other cases the generator **28** may be connected to a mechanical energy source elsewhere in the existing power train, for example to the gearbox or crank assembly of a pump jack, or to a hydraulic motor connected to the pump **26**. In other cases, the well site may have an existing generator **28** in place, for example already connected to be driven by the engine **24**, and in such a case the mining device **12** may be connected to such generator **28** to receive power for operations.

[0044] Referring to FIG. **2**, the mining device **12** may be powered by a generator **28** that is retrofitted, or already present, at a well site independent of the prime mover engine **24**. One or more such components may be housed in an enclosure such as an engine building **50**. In the example shown during operation the generator **28** is connected to be driven by an engine **56**, referred to as a first engine, while a second engine **24** is present to act as the prime mover to pump the well **14**. Prior to using the combustible gas to power the mining device **12**, a user may connect the generator **28** to an existing engine **56**, or may connect a gen-set comprising engine **56** and generator **28** to the gas supply, such as through lines **43** connected to a gas tree **22** on site. The engine **56** and generator **28**, or just the generator **28**, may be supplied as part of the mining device **12** in some

cases, for example as a skid or trailer-mounted unit, in order to provide a turnkey or plug-and-play system that may be transported to the well **14**, hooked up to the gas supply or tree **22**, and operated.

[0045] Referring to FIG. **3**, the mining device **12** may be powered by gas from a plurality of sources, such as a plurality of remote oil wells **14**A-D. The plurality of remote oil wells **14**A-D may be located on a multi-well pad **118**, for example a plurality of horizontal wells that penetrate the same hydrocarbon reservoir. The plurality of remote oil wells **14**A-D may include one or more satellite wells. A satellite well includes a well that is separate from a main group of wells or another well, but whose production is directed to a common processing facility. A satellite well may include a well that penetrates the same hydrocarbon reservoir as other wells in the plurality of wells. Each of the plurality of remote oil wells **14**A-D may have respective casinghead gas lines **60** and oil or emulsion lines **58**, which in the examples shown are bussed or grouped together, though such grouping is not necessary and in some cases independent lines may be used for each well or a group of one or more wells. The gas supply line or lines **60** may feed an engine **56** that drives a generator **28** that powers a mining device **12**.

[0046] Referring to FIG. **3**, the source of combustible gas may be an oil storage or processing unit, for example a production storage tank or tanks **34**A-B. The tanks **34** may store emulsion, for example a mixture of oil and water, which may be supplied via one or more emulsion or oil lines **58** from wells **14**A-D. The source of natural gas may comprise oil storage production tank **34** connected to receive oil produced from the remote oil well **14**. Oil storage production tank **34** may store, and in some cases separate, emulsion **38**, which may release vapor such as combustible gas **36** over time. A gas outlet, such as a vapor recovery unit **66**, may be connected to supply natural gas from the oil storage production tank **34** to the engine **56**. A compressor **62** or other suitable device may be used to pressurize the gas supplied to engine **56**. The engine **56** and generator **28** may form a standalone unit or may be connected for other functions on the site, such as to pump a well or power communications or electrical equipment. Pressurized natural gas from compressor **62** may be used to fuel lease equipment **64**, such as control equipment, communications equipment, surveillance equipment, heaters, or other components. Excess or unused gas may be directed to a gas disposal or storage device such as an atmospheric vent or combustion device, in this case a flare **68**. Gas may be diverted from flare **68** to engine **56** via an excess gas line **70**.

[0047] Referring to FIG. **3**, in some cases a method of installing the system **10** on site includes reducing the amount of combustible gas that is wasted on site. For example, the method of install may include disconnecting the source of combustible gas, in this case from tanks **34** and/or line **60**, from an atmospheric vent or combustion device, in this case flare **68**, or to atmosphere via a vent **52** (FIG. **1**). The source of combustible gas may be initially connected to operate the blockchain mining device **12**. Once disconnected, the atmospheric vent or combustion device may be unused in the future, or may be used only in certain circumstances. In some cases combustible gas is diverted at least partially from the atmospheric vent or combustion device to operate the blockchain mining device **12**, so that relatively less gas is wasted during operation. In such cases the flare **68** may remain connected to the source of gas, for example to receive a lesser feed of gas than prior to the installation of mining device **12**, and in other cases to receive diverted excess gas in certain circumstances for example as described further elsewhere in this document. An atmospheric vent or combustion device is an example of a gas disposal device, and includes a flare, a vent to the atmosphere, an incinerator, a burner, and other suitable devices.

[0048] A blockchain is a form of database, which may be saved as a distributed ledger in a network of nodes that maintains a continuously-growing list of records called blocks. Each block contains a timestamp and a link to a previous block. The data in a block cannot be altered retrospectively without significant computational effort and majority consensus of the network. The first blockchain was conceptualised by Satoshi Nakamoto in 2008 and implemented the following year as a core component of the digital currency, BITCOIN™, where it serves as the public ledger for all transactions. Through the use of a peer-to-peer network and a distributed timestamping server, a blockchain database is managed autonomously. The administration of BITCOIN™ currency is currently the primary use for blockchain technology, but there are other use cases for blockchain technology to maintain accurate, tamper-proof databases. Examples include maintaining records of land titles and historical events. While the potential in blockchain technology is vast, BITCOIN™ remains the most widely used today.

[0049] By design blockchains are inherently resistant to modification of the data—once recorded, the data in a block cannot be altered retroactively without network consensus. Blockchains are an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way. The ledger itself can also be programmed to trigger transactions automatically. Blockchains are secure by design and an example of a distributed computing system with high byzantine fault tolerance. Decentralised consensus can therefore be achieved with a blockchain. This makes blockchains suitable for the recording of events, medical records, and other records management activities, identity management, transaction processing and proving provenance. This offers the potential of mass disintermediation and vast repercussions for how global trade is conducted.

[0050] A blockchain facilitates secure online transactions. A blockchain is a decentralized digital ledger that records transactions on thousands of computers globally in such a way that the registered transactions cannot be altered retrospectively. This allows the participants to verify and audit transactions in an inexpensive manner. Transactions are authenticated by mass collaboration powered by collective self-interests. The result is a robust workflow where participants' uncertainty regarding data security is marginal. The use of a blockchain removes the characteristic of infinite reproducibility from a digital asset. It confirms that each unit of digital cash was spent only once, solving the long-standing problem of double spending. Blockchains have been described as a value-exchange protocol. This exchange of value can be completed more quickly, more safely and more cheaply with a blockchain. A blockchain can assign title rights because it provides a record that compels offer and acceptance. From the technical point of view a blockchain is a hashchain inside another hashchain.

[0051] A blockchain database may comprise two kinds of records: transactions and blocks. Blocks may hold batches of valid transactions that are hashed and encoded into a Merkle tree. Each block may include the hash of the prior block in the blockchain, linking the two. Variants of this format were used previously, for example in Git, and may not by itself be sufficient to qualify as a blockchain. The linked blocks form a chain. This iterative process confirms the integrity of the previous block, all the way back to the original genesis block. Some blockchains create a new block as frequently as every five seconds. As blockchains age they are said to grow in height. Blocks are structured by division into layers.

[0052] Sometimes separate blocks may be validated concurrently, creating a temporary fork. In addition to a secure hash based history, each blockchain has a specified algorithm for scoring different versions of the history so that one with a higher value can be selected over others. Blocks that are not selected for inclusion in the chain are called orphan blocks. Peers supporting the database don't have exactly the same version of the history at all times, rather they keep the highest scoring version of the database that they currently know of. Whenever a peer receives a higher scoring version (usually the old version with a single new block added) they extend or overwrite their own database and retransmit the improvement to their peers. There is never an absolute guarantee that any particular entry will remain in the best version of the history forever, but because blockchains are typically built to add the score of new blocks onto old blocks and there are incentives to only work on extending with new blocks rather than overwriting old blocks, the probability of an entry becoming superseded goes down exponentially as more blocks are built on top of it, eventually becoming very low. For example, in a blockchain using the proof-of-work system, the chain with the most cumulative proof-of-work is always considered the valid one by the network. In practice there are a number of methods that can demonstrate a sufficient level of computation. Within a blockchain the computation is carried out redundantly rather than in the traditional segregated and parallel manner.

[0053] Maintaining a blockchain database is referred to as mining, which refers to the distributed computational review process performed on each block of data in a block-chain. This allows for achievement of consensus in an environment where neither party knows or trusts each other. Those engaged in BITCOIN™ mining are rewarded for their effort with newly created BITCOIN™s and transaction fees, which may be transferred to a digital wallet of a user upon completion of a designated task. BITCOIN™ miners may be located anywhere globally and may be operated by anyone. The mining hardware is tied to the blockchain network via an internet connection. Thus, little infrastructure is needed to operate and contribute to the system. All that is required to become a BITCOIN™ miner is the appropriate computer hardware, an internet connection and low cost electricity. The cheaper the electricity the more reward the miner will receive relative to competition, other miners.

[0054] Mining is the process of adding transaction records to BITCOIN™'s public ledger of past transactions. This ledger of past transactions is called the blockchain as it is a chain of blocks. The blockchain serves to confirm transactions to the rest of the network as having taken place. BITCOIN™ nodes use the blockchain to distinguish legitimate BITCOIN™ transactions from attempts to re-spend coins that have already been spent elsewhere Mining may be intentionally designed to be resource-intensive and difficult so that the number of blocks found each day by miners remains steady. Individual blocks may be required to contain a proof-of-work to be considered valid. This proof-of-work is verified by other BITCOIN™ nodes each time they receive a block. BITCOIN™ uses the hashcash proof-of-work function.

[0055] One purpose of mining is to allow BITCOIN™ nodes to reach a secure, tamper-resistant consensus. Mining may also be the mechanism used to introduce BITCOIN™s into the system: Miners are paid any transaction fees as well as a subsidy of newly created coins. This both serves the purpose of disseminating new coins in a decentralized manner as well as motivating people to provide security for the system. BITCOIN™ mining is so called because it resembles the mining of other commodities: it requires exertion and it slowly makes new currency available at a rate that resembles the rate at which commodities like gold are mined from the ground.

[0056] Mining requires computational effort in the form of CPU cycles (CPU=central processing unit or central processor) to run a cryptographic hashing algorithm associated with the particular blockchain protocol. For a given mining processor, one can modify the computational effort through changing the core voltage or the clock rate of the processor. Doing so may result in more or less power consumed by the mining processor, and in some embodiments within this document such changes are described as changing the mining activity, or hashrate.

[0057] As the total network computational effort (or hashrate) increases on a blockchain over time, the probability for an individual miner to find a block and receive a reward diminishes. Today the BITCOIN™ network is so large that most individuals engaged in mining BITCOIN™ typically mine in pools using protocols such as the Stratum Mining Protocol. This allows individual miners to increase their reward frequency as a trade-off for splitting the block reward with the rest of the pool. Miners who are pool mining do not need the associated equipment needed to run a mining node as they only need compute and submit proof-of-work shares issued by the mining pool.

[0058] Since the energy cost of running blockchain mining equipment is its primary operating cost, a trend towards mining on low-cost hydroelectric power has become prevalent. This trend has promoted the centralization of blockchain miners in specific countries with abundant hydroelectric power, as miners who do not have access to cheap hydroelectricity cannot mine profitably because they are competing with the miners who do have access. BITCOIN™ mining centralization has been occurring in China where there is abundant low cost hydroelectric power. Centralization in blockchain mining is undesirable because the premise behind the blockchain innovation is not to have to trust a third party and to have inherent confidence and security through a decentralized, distributed network. There exists a need to further decentralize BITCOIN™ and other blockchain mining through a more decentralized source of low-cost power.

[0059] Referring to FIG. **6**A, a blockchain network may be a peer to peer network **120** accessible via the internet. The blockchain database may be stored as a distributed database **132** on plural nodes **122**, for example nodes **122**A-F, in the peer to peer network **120**. A protocol may be put in place to

ensure that each copy of the database on each node is updated in a reliable fashion when one copy is updated on one node. Each copy of the blockchain database may store transactional information for a digital currency such as BITCOIN™. Nodes **122**A-F may be electronic devices **126**, for example desktop computers, laptop computers, tablet computers, cellular telephones, servers, or other suitable devices. Nodes **122**A-F may communicate with one another over wired or wireless communication paths **138**, for example through the internet. Each path **138** may be created through communication via switches, routers, modems, and other network equipment. Network **120** may include any number of nodes, for example tens, hundreds, thousands, millions, or more nodes. Nodes **122**A-F may communicate to maintain a distributed global ledger of all official transactions. One or more of the nodes **122**A-F may store a copy of the global ledger, for example a complete copy of the global ledger or a partial copy of the global ledger.

[0060] Referring to FIG. **6**B, each node **122** may correspond to and be defined by a physical device **126**, such as a computer. Device **126** may have one or more of storage and processing circuitry **128** and mining circuitry **130** if the node operates as a miner. Storage and processing circuitry **128** may have storage circuitry, for example hard disk drive storage, nonvolatile memory such as flash memory or other electrically-programmable-read-only memory configured to form a solid state drive, or volatile memory such as static or dynamic random-access-memory. Processing circuitry of storage and processing circuitry **128** may be used to control the operation of device **126**. Storage circuitry **128** may store one or more copies of a portion or the entirety of the distributed database **132**. Such processing circuitry may include suitable hardware components such as microprocessors, microcontrollers, and digital signal processors, or dedicated processing circuits such as application specific integrated circuits Mining circuitry **130**, for example an integrated circuit chip, may be used to perform data mining operations, for example verifying cryptocurrency transactions. Network communication hardware **131** may be used to communicate with other nodes and the network in general.

[0061] Referring to FIGS. **6**A-B, every transaction added to the global ledger via nodes **122** may be verified by other the other nodes to help ensure validity of the ledger. Successfully mining a block may provide a reward of the digital currency, wherein, the processor circuitry **128** or another processor may assign the reward to a digital wallet or address stored on a computer readable medium.

[0062] Referring to FIG. **6**C, storage and processing circuitry **128**, may maintain or store a blockchain database **132**. The blockchain database **132** may store data as a series of interconnected blocks **134**, for example blocks **134**A-C. Each block **134** may have a respective header and contents and the header may contain the previous block's hash. Such information may be used in linking a new block, for example block **136**, into the blockchain database **132**. A new block **136** may be added to the chain as transactions are verified and confirmed into the blockchain. The integrity of the blockchain may be verified by known methods, and the linking of each block to previous blocks acts to create a liable and traceable path of title to anonymously but reliably verify a chain of title for a specific quantity of currency that has been the subject of one or more transactions.

[0063] Referring to FIG. **4**, each blockchain mining device **12** may be composed of suitable components. The blockchain mining device **12** may have a network interface, such as network equipment **88**, and one or a plurality of mining processors **92** (**92**A-**92**E for example). The network interface may be connected to receive and transmit data through the internet to a node on the network **120** (FIG. **6**A), or to a mining pool (not shown), that stores or has access to a blockchain database, which may be for a digital currency. The mining processor or processors may be connected to the network interface and adapted to mine new transactions into the blockchain database and to communicate with the blockchain database. Referring to FIG. **4**, the network interface or interfaces (network equipment **88**) may have a configuration suitable for receiving and transmitting data through the internet to the network. Referring to FIG. **6**, a network interface may comprise one or more communication device such as a network antenna **96**A, a satellite antenna or dish **96**B, a cellular antenna, or a radio antenna. The network equipment **88** may include or be connected to a modem.

[0064] Referring to FIG. **6**, system **10** may be mounted within a portable enclosure **98** suitable for transporting blockchain mining device **12** between locations. The blockchain mining device **12** (FIG. **1**) may be skid or trailer-mounted. The blockchain mining device **12** may be located in a portable enclosure **98**, for example an intermodal transport container as shown. The portable enclosure **98** may have an access door **102** such as a man door, for example to permit entry and exit of a person such as equipment maintenance staff into and out of the enclosure **98**. Portable enclosure **98** may have an end gate **100** to permit entry and exit of data mining equipment, for example mining processors **92**, or power generating equipment such as engine **56** and generator **28**, into and out of the enclosure **98**. One or more network communications equipment **96**, for example network antenna **96**A such as a cellular network antenna or radio network antenna and/or satellite internet dish **96**B may be mounted to the enclosure **98**, for example to a top side **98**A of the enclosure **98** or at another suitable location. Enclosure **98** may have an air supply, such as a centrifugal fan **106**, for example driven by a motor **104**, in order to cool and ventilate internal components to prevent system downtime or damage from overheating. Enclosure **98** may have one or more exhaust fans **108** and/or louvers, for example to facilitate air flow out of, or into, enclosure **98** for heat dissipation from enclosure **98**. Enclosure **98** may have an air supply, such as an air supply fan **106**, and may have an air supply filter (not shown) and conditioning equipment such as a dehumidifier (not shown) to provide a quality air supply for the enclosure **98**.

[0065] Referring to FIG. **6**, an intermodal container is a relatively large rectangular box-shaped standardized shipping container, designed and built for intermodal freight transport, meaning these containers can be used across different modes of transport—from ship to rail to truck—without unloading and reloading their cargo. Intermodal containers are primarily used to store and transport materials and products efficiently and securely in the global containerized intermodal freight transport system, but smaller numbers are in regional use as well. These containers are known under a number of names, such as simply container, cargo or freight container, ISO container, shipping, sea or ocean container, container van or (Conex) box, or seacan. Intermodal containers exist in many types and a number of

standardized sizes, but ninety percent of the global container fleet are so-called dry freight or general purpose containers, which are durable closed steel boxes, mostly of either twenty or forty foot standard length. Common heights are 8 feet 6 inches and 9 feet 6 inches—the latter are known as High Cube or Hi-Cube containers. Intermodal containers often include corrugated walls **101** for strength. Each corner of the container may include a twistlock fitting **103** for securing the container to other containers and to various transportation devices such as a container trailer for a road-based tractor unit. Reinforcing beams **105** may span the edges of the container, for example the vertical columns that make up the four corners between sidewalls, and the horizontal beams that make up the longitudinal and lateral side edges of the base of the container.

[0066] Referring to FIG. **4**, an example layout is illustrated of the components that may make up a mining device **12**. The enclosure **98** may contain one or more of a meter **72**, a splitter **74**, a ventilation fan **76**, a chiller **78**, a step-down transformer **80**, a distribution panel **82**, a contactor panel **84**, a controller **86**, network equipment **88** such as a modem and a network switch, a thermistor or temperature sensor **90**, and one or more mining processors **92** such as processors **92**A-E. The generator **28** provides power to the mining device **12**. In some cases, the power is metered via meter **72** so the user can know how much to pay the owner of the gas, and then the power may be split up.

[0067] Referring to FIG. **4**, the generator **28** may produce polyphaser power, such as three phase power, which may be useful to run large loads such as the ventilation fan **76** and chiller **78**. The power may travel into a step-down transformer **80**. A transformer **80** may or may not be required depending on what voltage the generator makes. Transformer **80** may convert the input voltage to the required voltage to run the rest of the equipment. The transformer or transformers **80** may also convert the three phase power to single phase power. After the transformer the power may travel into a distribution panel **82**. The panel **82** may feed power into the rest of the equipment. A contactor panel **84** may be used to switch on and off various mining processor circuits each connected to one or more mining processors **92**. Different mining processor circuits may be designed for different voltages, as some mining processor power supplies run on 120V, and some run on 208V.

[0068] Referring to FIG. **4**, the network equipment **88** block may provide a source of internet connection. A satellite/cellular/and/or radio antenna or other network communication equipment **96** may be fitted on the mining device **12** and connected to a modem. The modem may feed a network switch that has ethernet ports. Each mining processor controller may need one ethernet port. The network connection may also feed a controller or controllers **86**, which may be a programmable logic controller (PLC), which may be accessed remotely. The controller **86** may be connected to at least a thermistor **90** (temperature sensor) within the mining device **12**, to allow the controller **86** to control the ventilation and chilling loads within the enclosure **98**. The controller **86** may control the contactor panel **84** switches to open and close circuits to add or remove mining processors **92** from operation. Each mining processor **92** may have a variety of configurations, but generally may include at least a power supply, a controller board and mining circuitry, such as an ASIC circuit. Various mining circuitry examples include CPU (central processing unit), GPU (graphics processing unit), FPGA (Field-Programmable Gate Array), and ASIC (application specific integrated circuit). The components of an ASIC mining processor include the hash boards (each board has numerous chips that is doing the hashing), a controller (to communicate with the network and optimize the mining processors chip frequency and fans for cooling), and a power supply (typically converts AC input power to DC power for the ASIC). Each mining processor **92** may be positioned on racks or shelving units.

[0069] Referring to FIG. **4**, the blockchain mining device **12** may comprise a controller **86** connected to operate one or more aspects of the blockchain mining device **12**. The controller **86** may be connected to operate a cooling system, for example having a ventilation fan **76** and a chiller **78**, to maintain the mining processor **92** within a predetermined operating range of temperature. For example, if the internal temperature within the mining device **12** spikes above a predetermined maximum predetermined temperature, the air ventilation system may initiate or ramp up, and if the temperature contains past a second, relatively higher maximum predetermined temperature, the chilling unit may initiate or ramp up to achieve an air-conditioning effect. Similarly, if the temperature drops below a minimum predetermined temperature, a heating system (not shown) may initiate that may or may not leverage the air ventilation infrastructure to distribute heat. Plural controllers may be incorporated, for example to carry out different tasks, for example one controller for temperature control and another for mining processor control. The enclosure **98** may be structured to insulate its contents from the elements. The enclosure **98** may have a back-up heating device such as a space heater (not shown), for example to be used to heat the enclosure **98** in case of shut down in cold weather.

[0070] Referring to FIG. **4**, one or more controllers **86** may modulate operating power loading to operate within the varying and gradually diminishing gas supply levels provided by a remote oil well or other hydrocarbon production, storage, or processing facility. The controller **86** may be connected to modulate a power load level used by the blockchain mining device **12**, for example by increasing or decreasing the mining activity, or hashrate, of the mining processor **92**. The mining processor **92** may comprise a plurality of processors, and the controller **86** may be connected to modulate the operating power loading level by increasing or decreasing the number of mining processors **92** that are actively engaged in mining, such as powering down one or more mining processors **92**.

[0071] The controller **86** may be connected to modulate the power load level in response to variations in a supply or production rate of natural gas from the source of natural gas, for example a production rate of the well **14**. Referring to FIG. **5**A, over a relatively short time period, such as a single day, the controller **86** may modulate the power load by modulating the mining activity, or hashrate, of a mining processor **92** to correspond with either or both a) readings from a production rate sensor (not shown), or b) a measured gas production time profile based on recent (for example readings taken over the last week) historical gas production readings taken from the well, such as is shown in FIG. **5**A. Thus, as gas production increases, so might the controller **86** increase mining activity, or hashrate, of mining processor **92**, thereby drawing more power which results in a larger power load and gas consumption of the engine **56**. As gas

production decreases as it is known to do in a relatively predictable and cyclical fashion as shown, the mining activity may decrease. Adjustments may be made in real time to maximize the use of the casinghead gas produced and to minimize waste of either electricity generated or excess gas sent to a disposal device.

[0072] Referring to FIG. **5**A, in some cases the power load level **152** may be set in relation to a daily minimum production rate **155**B of natural gas. A production rate of combustible gas from the remote oil well **14** may vary between a daily minimum production rate **155**B and a daily maximum production rate **155**A. At least while the production rate is above the daily minimum production rate **155**B, or for a period of time of eight, twelve, twenty-four, or more hours, the controller **86** may be set to limit the power load level to at or below a power level **152** producible by the generator **28** when the production rate is at the daily minimum production rate. Thus, because the power load level is set to the minimum daily power supply from the generator **28**, the controller **86** may retain a stable and consistent number of mining processors **92** in operation all day long. Venting may be decreased and little control philosophy may be required. Such a method may not completely eliminate waste such as venting however waste is reduced.

[0073] Referring to FIG. **1**, while the power load level is set to the daily minimum, the excess gas or electricity may be addressed in a suitable fashion. In the example shown, excess electricity produced by the generator **28** is diverted to an electricity disposal device, in this case a load bank **32** when the production rate is above the daily minimum production rate **155**B. In some cases the controller **86** or another suitable device, may divert excess gas from reaching engine **24**, for example to a suitable gas disposal or storage device, such as an atmospheric vent, a flare, or other device. One or more valves, such as an instrumented valve, may be used for such diversion. In some cases excess gas sent to the engine will automatically divert to disposal through the gas tree, as such equipment may already have pressure regulation installed and set such that above a certain pressure excess gas is diverted to vent or flare. The load bank may be controlled to load up the engine so that all power generated in excess of the required amount to power the mine can be dissipated in the load bank as heat. In such a fashion the user can eliminate venting altogether as long as the engine is sized to consume the maximum available gas supply.

[0074] Referring to FIG. **5**A, in some cases the power load level may be set in relation to a daily maximum production rate **155**A of natural gas, with shortfall made up by a backup source of fuel or electricity. Referring to FIG. **1**, the controller **86** may be set to limit the power load level **150** to above a power level producible by the generator **28** when the production rate **155** is at the daily minimum production rate **155**B. In some cases the power level is set to be limited at least while the production rate **155** is above the daily minimum production rate **155**B, or for another suitable time period such as eight, twelve, twenty-four or longer periods of time. The power load level may be set to at, below, or above the maximum power level producible by the generator **28** when the production rate **155** is at the daily maximum production rate **155**A. A backup source, of fuel or electricity, in this case one or more of propane tanks **30**A, **30**B, underground fuel supply line **46**, and gas outlet line **42** from production storage tank **34**, may be connected make up shortfalls in fuel or electricity, respectively, required to supply the blockchain mining device **12** with the power load level. In such an example vented gas is eliminated but back-up fuel use may be increased, thus operating costs may rise relative to the daily low embodiment (embodiments where power load level is set in relation to the daily minimum production rate **155**B in FIG. **5**A) because of the requirement for the backup fuel or electricity source.

[0075] On a well site there may be one or more uses for produced gas, and thus the production rate of the well may be higher than the production rate of gas that arrives at the engine **24** or **56**, however, due to the varying production rate, the fluctuation in the graph gives an indication of the proportional fluctuation in the actual production rate received by the engine **24** or **56** as the case may be. In some cases the engine **24** or **56** is undersized and cannot consume the maximum available gas, in which case the gas is sent to a gas disposal or storage device via pressure regulation in the gas tree and/or at the engine. The engine may comprise a throttle that permits some variation in gas consumption and power production at the engine level, and in some cases the controller **86** is set to operate the throttle. In some cases the power load level may be set in between the daily maximum and minimum production rates, with a backup energy or fuel source and a method of disposing or storing of excess gas.

[0076] Referring to FIG. **5**B, the graph shows a typical scenario where gas production decreases over time. As the natural gas production rate **155** decreases, individual mining processors **92**A-E may be removed or disengaged from the device **12** so that the load on the engine **24** or **56** is reduced correspondingly, thereby reducing the required natural gas consumption of the engine **24** or **56** to match or correspond with the decline in gas availability. FIG. **5**B depicts an engine fuel consumption level **154** that is modulated over time in a stepped or stepdown fashion in relation to the gradually decreasing production rate **155** of the well.

[0077] In the claims, the word "comprising" is used in its inclusive sense and does not exclude other elements being present. The indefinite articles "a" and "an" before a claim feature do not exclude more than one of the feature being present. Each one of the individual features described here may be used in one or more embodiments and is not, by virtue only of being described here, to be construed as essential to all embodiments as defined by the claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A system comprising:

a source of combustible gas produced from an oil production, storage, or processing facility;

a generator connected to the source of combustible gas; and

a blockchain mining device connected to the generator.

2. The system of claim **1** isolated from a sales gas line and an external electrical power grid.

3. The system of any one of claims **1**-**2** in which:

the oil production, storage, or processing facility comprises a remote oil well;

the source of combustible gas comprises the remote oil well; and

the remote oil well is connected to produce a continuous flow of combustible gas to power the generator.

4. The system of claim **3** further comprising a combustion engine connected to the source of combustible gas and connected to drive the generator.

5. The system of claim **4** in which the combustion engine is a prime mover that is connected to produce oil from the remote oil well.

6. The system of claim **4** in which the combustion engine is a first combustion engine, and further comprising a second combustion engine that is a prime mover that is connected to produce oil from the remote oil well.

7. The system of any one of claims **1-6** in which:

the oil production, storage, or processing facility comprise an oil storage or processing unit;

the source of combustible gas comprises the oil storage or processing unit, which has a gas outlet connected to supply combustible gas to operate the generator; and

the oil storage or processing unit is connected to receive oil produced from a remote oil well.

8. The system of any one of claims **1-7** in which the generator and blockchain mining device are located adjacent to the oil production, storage, or processing facility.

9. The system of any one of claims **1-8** in which the oil production, storage, or processing facility comprises a remote oil well, which comprises a plurality of remote oil wells, and one or both of the following conditions are satisfied:

the plurality of remote oil wells are located on a multi-well pad; or

the plurality of remote oil wells include a satellite well.

10. The system of any one of claims **1-9** in which:

the blockchain mining device has a network interface and a mining processor;

the network interface is connected to receive and transmit data through the internet to a network that stores or has access to a blockchain database; and

the mining processor is connected to the network interface and adapted to mine transactions associated with the blockchain database and to communicate with the blockchain database.

11. The system of claim **10** in which:

the network is a peer to peer network;

the blockchain database is a distributed database stored on plural nodes in the peer to peer network; and

the blockchain database stores transactional information for a digital currency.

12. The system of any one of claims **10-11** in which a controller is connected to modulate a power load level exerted by the blockchain mining device on the generator, by increasing or decreasing the mining activity of the mining processor.

13. The system of claim **12** in which:

the mining processor comprises a plurality of mining processors; and

the controller is connected to modulate the maximum power load level by increasing or decreasing a maximum number of mining processors that are engaged in mining transactions.

14. The system of claim **13** in which:

the oil production, storage, or processing facility comprises a remote oil well;

the source of combustible gas comprises the remote oil well, which is connected to produce a continuous flow of combustible gas to operate the generator.

15. The system of claim **14** in which the controller is connected to modulate the power load level in response to variations in a production rate of combustible gas from the remote oil well.

16. The system of any one of claims **14-15** in which:

a production rate of combustible gas from the remote oil well varies between a daily minimum production rate and a daily maximum production rate; and

while the production rate is above the daily minimum production rate, the controller is set to limit the power load level to at or below a power level producible by the generator when the production rate is at the daily minimum production rate.

17. The system of claim **16** in which the controller is set to divert to a load bank excess electricity produced by the generator.

18. The system of any one of claims **14-15** in which:

a production rate of combustible gas from the remote oil well varies between a daily minimum production rate and a daily maximum production rate;

the controller is set to limit the power load level to above a power level producible by the generator when the production rate is at the daily minimum production rate; and

a backup source, of fuel or electricity, is connected make up a shortfall in fuel or electricity, respectively, required to supply the blockchain mining device with the power load level.

19. The system of any one of claims **1-18** in which a controller is connected to operate a cooling system to maintain the blockchain mining device within a predetermined operating range of temperature.

20. The system of any one of claims **1-19** in which the blockchain mining device is mounted on a skid or trailer.

21. The system of claim **20** in which the skid or trailer comprises a generator driven by an engine, which is connected to the source of combustible gas.

22. The system of any claim **21** in which the engine comprises a turbine.

23. The system of any one of claims **1-22** in which the blockchain mining device comprises an intermodal transport container.

24. A method comprising using a source of combustible gas produced at a hydrocarbon production well, storage, or processing facility, to produce electricity to operate a blockchain mining device located at the hydrocarbon production well, storage, or processing facility, respectively.

25. The method of claim **24** further comprising, prior to using the source of combustible gas:

disconnecting the source of combustible gas from a combustible gas disposal device at the hydrocarbon production well, storage, or processing facility; and

connecting the source of combustible gas to operate the blockchain mining device.

26. The method of any one of claims **24-25** further comprising:

connecting the source of combustible gas to operate the blockchain mining device; and

diverting gas from a combustible gas disposal or storage device to operate the blockchain mining device.

27. The method of any one of claim **25-26** in which the combustible gas disposal or storage device comprises one or more of a flare, a vent to the atmosphere, an incinerator, or a burner.

28. The method of any one of claims **24-27** in which the hydrocarbon production well, storage, or processing facility comprises an oil or gas well that is isolated from a sales gas line and an external electrical power grid.

29. The method of any one of claims **24-28** in which the source of combustible gas is a remote oil or gas well, and further comprising producing a continuous flow of combustible gas to power a generator connected to operate the blockchain mining device.

30. The method of claim **29** in which producing further comprises supplying combustible gas to a combustion engine that is connected to drive the generator.

31. The method of claim **30** in which the source of combustible gas is a remote oil well, and further comprising using the combustion engine as a prime mover to produce oil from the remote oil well.

32. The method of claim **31** in which, prior to using the source of combustible gas, the combustion engine is under loaded as the prime mover, and further comprising connecting the generator to a power takeoff connected to the combustion engine.

33. The method of claim **30** in which the combustion engine is a first combustion engine, and further comprising:

prior to supplying combustible gas to the first combustion engine, connecting the first combustion engine to receive combustible gas from the remote oil well; and

using a second combustion engine as a prime mover to produce oil from the remote oil well.

34. The method of any one of claims **29-33** further comprising operating the blockchain mining device to:

mine transactions with the blockchain mining device; and

communicate wirelessly through the internet to communicate with a blockchain database.

35. The method of claim **34** further comprising modulating, using a controller, a power load level exerted by the blockchain mining device on the generator, by increasing or decreasing a mining activity of the blockchain mining device.

36. The method of claim **35** in which:

the blockchain mining device comprises a plurality of mining processors; and

modulating comprises modulating the power load level by increasing or decreasing a maximum number of mining processors that are engaged in mining transactions.

37. The method of claim **36** in which modulating comprises modulating the power load level in response to variations in a production rate of combustible gas from the remote oil or gas well.

38. The method of any one of claims **36-37** in which:

a production rate of combustible gas from the remote oil or gas well varies between a daily minimum production rate and a daily maximum production rate; and

modulating comprises limiting, while the production rate is above the daily minimum production rate, the power load level to at or below a power level producible by the generator when the production rate is at the daily minimum production rate.

39. The method of claim **38** further comprising diverting to a load bank excess electricity produced by the generator.

40. The method of any one of claims **36-37** in which:

a production rate of combustible gas from the remote oil or gas well varies between a daily minimum production rate and a daily maximum production rate;

modulating comprises limiting the power load level to above a power level produced by the generator when the production rate is at the daily minimum production rate; and

supplying from a backup fuel or electricity source a shortfall in fuel or electricity, respectively, required to supply the blockchain mining device with the power load level.

41. The method of claim **40** in which the power load level is limited to above a power level produced by the generator when the production rate is at the daily maximum production rate.

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