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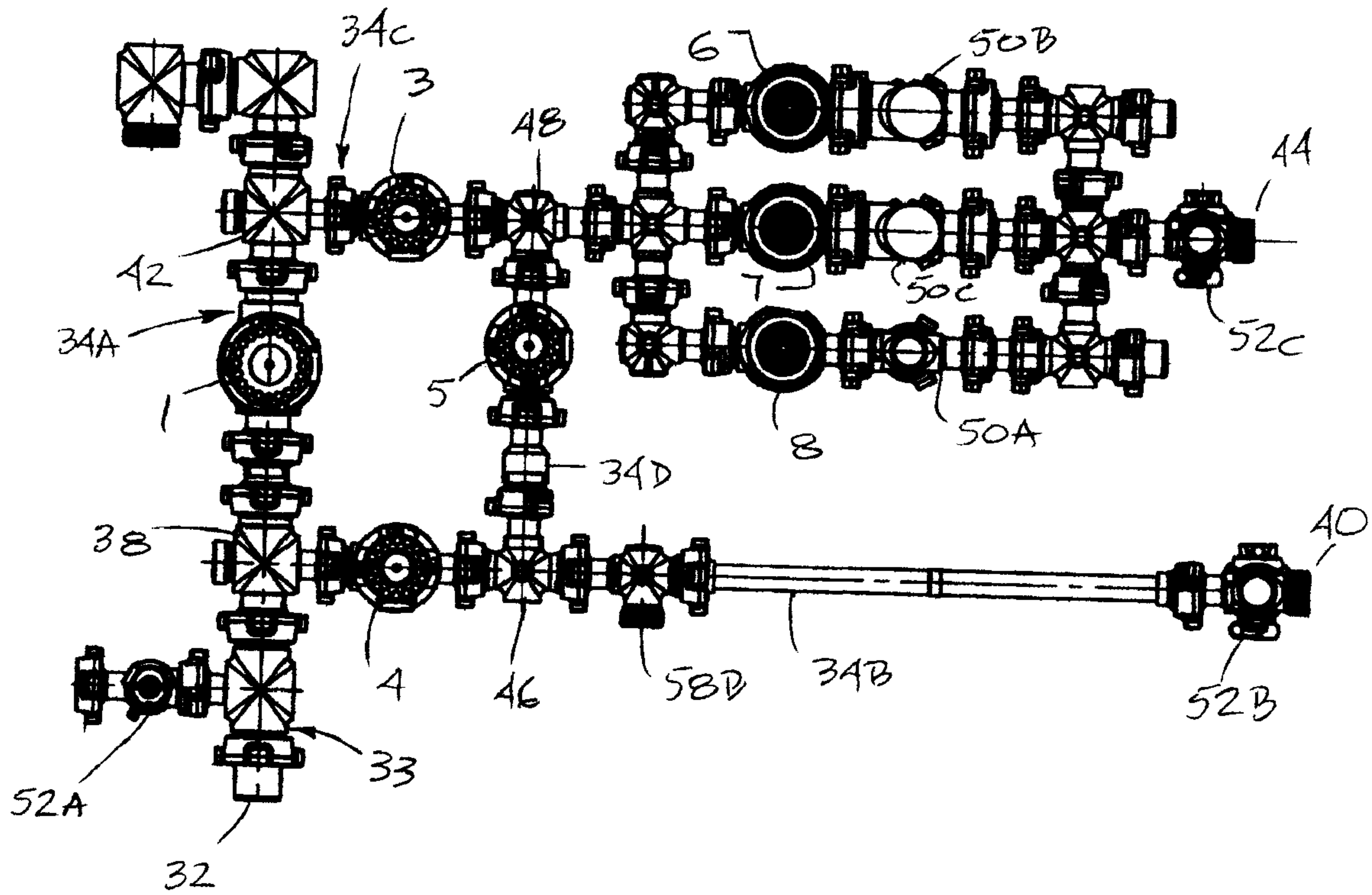
(54) Titre : INSTALLATION D'ENTRETIEN DE PUITS DE FORAGE ET COLLECTEUR
(54) Title: WELL SERVICING RIG AND MANIFOLD ASSEMBLY



(57) Abrégé/Abstract:
A well servicing rig for communicating with a fluid source and an effluent reservoir (such as a flow back tank) has an apparatus for holding and dispensing coiled tubing. A manifold assembly is advantageously located on the rig for routing the pressurized fluid (such as nitrogen gas mixed with proppant) from the fluid source between the coiled tubing apparatus, the well and the effluent reservoir. The manifold assembly controls the flow of the fluid to perform fracturing operations, for reverse fluid circulation, for a common coiled tubing operation, for pressure testing, and the like. The assembly includes remotely controlled valves and pressure transducers for controlling the fluid flow, and chokes for diffusing fluid energy prior to entering the effluent reservoir. The rig, fluid source, effluent reservoir and a fluid pumper provide a novel method of servicing an underground formation (such as a coal bed) for natural gas.

ABSTRACT

A well servicing rig for communicating with a fluid source and an effluent reservoir (such as a flow back tank) has an apparatus for holding and dispensing coiled tubing. A manifold assembly is advantageously located on the rig for routing the pressurized fluid (such as nitrogen gas mixed with proppant) from the fluid source between the coiled tubing apparatus, the well and the effluent reservoir. The manifold assembly controls the flow of the fluid to perform fracturing operations, for reverse fluid circulation, for a common coiled tubing operation, for pressure testing, and the like. The assembly includes remotely controlled valves and pressure transducers for controlling the fluid flow, and chokes for diffusing fluid energy prior to entering the effluent reservoir. The rig, fluid source, effluent reservoir and a fluid pumper provide a novel method of servicing an underground formation (such as a coal bed) for natural gas.

Agent File No. 282.3

TITLE: WELL SERVICING RIG AND MANIFOLD ASSEMBLY

FIELD OF THE INVENTION

The present invention relates generally to well servicing units, and in particular relates to a novel coiled tubing rig having a novel manifold assembly for routing and controlling fluid flow between a fluid source and an underground formation, such as a coal bed.

BACKGROUND OF THE INVENTION

A large assortment of various rigs and vehicles are currently required to service (namely to drill, fracture and the like) both conventional and coal bed methane wells for hydrocarbon production, such as natural gas. A term of art for "natural gas from coal" is "NGC". Conventional fracturing ("fracing") and stimulation of NGC formations currently requires about 13 or more vehicles/rigs for such an operation, including at least one trailer to transport numerous components of a conventional piping array to the NGC wellsite. The assembly and subsequent disassembly and transport of so many units to another wellsite upon completion of an operation is time consuming and highly labour intensive, and hence costly.

One particularly costly and time-consuming component of such set-up for a fracing operation is the erection of the piping array (also often referred to as a "manifold assembly"). Its formation results in an elaborate piping maze which snakes along the ground to operatively connect several pumpers (typically 3) and bulkers (typically 2) to a coiled tubing rig. The large work area footprint created by such set-up is undesireable and potentially dangerous should a worker trip on such piping.

What is therefore desired is a novel rig and manifold assembly which overcomes the problems and disadvantages of existing well site set-ups. Preferably, the need for repeated assembly and disassembly of an elaborate piping arrangement at a well site external to the various vehicles/rigs should be significantly reduced or eliminated by locating the novel manifold assembly on the novel coiled tubing rig. Further, the number of vehicles/rigs needed for a fracing operation should also be significantly reduced, preferably to as few as one high-rate pumper, one bulker and one coiled tubing unit, as well as an effluent reservoir such as a flow back tank. Hence, the set-up at a well site afforded by the novel rig and manifold assembly should be quicker, require less hardware and labour, and make a smaller footprint on site than conventional methods.

SUMMARY OF THE PRESENT INVENTION

According to the present invention, there is provided in one aspect a servicing rig for a well adapted to communicate with a fluid source and an effluent reservoir, said rig comprising:

a base;

a coiled tubing apparatus on said base for holding and dispensing coiled tubing;

a manifold assembly on said base for routing pressurized fluid from said fluid source between said coiled tubing apparatus, said well and said effluent reservoir.

The manifold assembly includes means for controlling the flow of said fluid through said assembly to selectively form at least one of a first fluid route to perform fracturing operations, a second fluid route for reverse fluid circulation, a third fluid route for common coiled tubing operations, and a fourth fluid route for pressure testing.

In another aspect the invention provides a manifold assembly for routing a fluid from a fluid source between a wellbore annulus, an effluent reservoir and a tubing apparatus on a well servicing unit, said assembly comprising:

an inlet for receiving said fluid;

a first line in fluid communication with said inlet and tubing apparatus;

a second line in fluid communication with said first line and said annulus;

a third line in fluid communication with said first line and said effluent reservoir;

a fourth line in fluid communication between said second and third lines;

wherein said first, second, third and fourth lines are adapted for location on said well servicing unit.

In yet another aspect the invention provides a method of servicing an underground formation comprising:

providing a fluid storage means;

providing a fluid pumping means capable of drawing fluid from said fluid storage means and supplying a sufficient fluid stream under sufficient pressure for servicing said underground formation;

providing a coiled tubing unit for receiving and introducing said fluid stream into said underground formation, said unit having a manifold assembly for routing and controlling said fluid stream between said unit and said underground formation; and,

providing an effluent reservoir for receiving fluid from said manifold assembly.

A crew truck should be provided for supplying fuel to said pumper and coiled tubing unit.

A high-pressure injection proppant system may be provided for introducing proppant upstream of said coiled tubing unit and downstream of said pumper.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is an elevational side view of a mobile coiled tubing unit with a manifold assembly mounted thereon accoring to a preferred embodiment of the present invention;

Figure 2 is a plan view of fig. 1;

Figure 3a is a rear view of the rig of fig. 1 showing the elevated mast in an operational position with an movable coiled tubing injector at three selected positions along the mast, but omitting other rig features for a better view of the mast;

Figure 3b is a view similar to fig. 3a but showing the mast reclined in a travel position;

Figure 3c is a front view of the rig of fig. 3a showinga control cab for an operator;

Figure 4 is a plan view of the manifold assembly of fig. 1 in isolation;

Figure 5 is an elevational side view of fig. 4;

Figure 6 is a schematic of the manifold assembly and portions of the coiled tubing unit of the preferred embodiment;

Figure 7 illustrates the vehicles for fracturing an underground formation with nitrogen gas and optionally sand according to the method of the present invention; and,

Figure 8 is a table showing the remote valve configurations for various manifold assembly operations.

LIST OF REFERENCE NUMBERS IN DRAWINGS

1-8	first to eigth remote valves
10	coiled tubing rig
12	trailer
14	mast
15	injector
15a	injector arch
17	control cab
18	coiled tubing reel
20	coiled tubing
22	connection
30	manifold assembly
32	inet to assembly 30
34a-34d	first to fourth fluid lines
36	extension of line 34a
38	first t-joint ("tee")
40	end of line 34b
42	second tee
44	end of line 34c
46	third tee
48	fourth tee

50a-50c	first to third chokes
52a-52c	first to third non-remote valves
58a-58b	pressure transducers
60	nitrogen pumper unit
62	“super queen” fluid storage unit
64	“crew” truck
66	HIPS (high-pressure injection proppant system) unit
68	flow back tank

DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is first made to figures 1 to 3c which show a servicing unit for an underground formation which in the preferred embodiment is in the form of a coiled tubing unit, or rig, generally indicated by the reference numeral 10. The present rig can service various types of hydrocarbon bearing formations, including coal formations (or beds). It is suited for typical coiled tubing functions, such as conventional stimulation operations relating to coiled tubing, as well as for fracturing ("fracing") operations of coal beds to enhance production of coal bed methane.

Some of the basic components of the rig are a base, a mast pivotally mounted relative to the base, and servicing equipment for a well, or wellbore, leading to the underground formation. "Servicing" is defined herein as typical functions related to coiled tubing, including stimulation and fracing operations . The base is a mobile carrier in the form of a wheeled trailer 12 adapted to be pulled by a motorized vehicle (not shown), or alternately the carrier itself may be self-propelled. The mast 14 at the rear of the carrier has a coiled tubing injector 15 mounted slidably thereto, and an injector arch 15a is operatively engaged with the injector to guide coiled tubing thereinto. In the fig. 1, 2 and 3b views, the mast is reclined in a travel position and the arch sits on the trailer, and in the fig.3a view the mast is elevated in an operating mode. Figure 3c shows other features at the front of the rig, such as a control cab 17 defining a treatment control centre. The above-mentioned equipment further includes a coiled tubing reel 18 mounted toward the front of the carrier 12 for holding and dispensing coiled tubing 20 in a known manner.

An important aspect of the invention is a manifold assembly 30 and its location, namely on the carrier. The manifold assembly routes and controls the the flow of fluid between an "external" fluid source, the well, andan effluent reservoir. It is possible to have the present manifold assembly configured (such as on a skid base) for placement onto and removal from the carrier when desired, but this is not preferred to avoid damaging components and for other reasons. Rather, in the preferred embodiment, the manifold assembly is mounted to the carrier in a fixed location near the reel and intermediate the reel and mast.

Referring now as well to figs. 4 to 7, the manifold assembly 30 has an inlet 32 to operably connect to the fluid source for fluid communication therewith. The fluid may be any gas or liquid or combination thereof, and may include solids such as proppants (e.g. sand or the like). In the preferred embodiment the fluid is nitrogen gas pumped under a high volume and pressure from a fluid source defined by a pumping means, namely a nitrogen pumping unit known as a "nitrogen pumper" 60, and a fluid storage means, namely a bulker 62, from which the pumper draws the fluid. Applicants have designed a novel high rate nitrogen pumper 60 (as described in co-pending Canadian patent application no. 2,507,073 filed May 11, 2005) for providing high capacity, high-pressure vaporized nitogen which is beyond the capability of conventional pumper units. Hence, one such nitogen pumper 60 should be sufficient to deliver the needed volume of nitogen gas to the inlet 32 for the rig 10 to perform its desired downhole operations. While it is possible for the manifold assembly to be configured to function with multiple inlets for communication with multiple conventional pumpers, this would dilute the many advantages of the present invention, and so is not preferred.

The inlet 32 is located at one end of a first fluid line 34a (in the form of a conduit or piping), such as a 3 inch (about 75 mm) treating line, which in effect provides fluid communication between the inlet 32 and the coiled tubing 20 via a connection 22 at the hub of the coiled tubing reel 18. An extension 36 of the first line 34a communicates between the connection 22 and the tubing 20. A valve 33, such as a high-pressure 3 inch (about 75 mm) check valve, at the inlet 32 prevents reverse fluid flow from the manifold assembly toward the fluid source.

A second fluid line 34b, such as a 2 inch (about 50 mm) treating line, serves to communicate with the first line 34a and the annulus of the wellbore. One end of the second line 34b is connected to the first line 34a via a first T-joint, or "tee" connection 38, downstream of the inlet 32, and the other end 40 is adapted to be connected to a line leading to the annulus. The "annulus" is defined herein as the portion of the wellbore forming a passage between the larger diameter production casing and the smaller diameter coiled (or production) tubing extending therethrough. Such passage allows for the flow of fluids through the wellbore, typically opposite to that of the tubing. It is noted that when describing the invention, all terms not defined herein have their common art-recognized meaning.

A third fluid line 34c, such as a 2 inch (about 50 mm) treating line, serves to communicate with the first line 34a and an effluent storage means in the form of a flow back tank 68 or the like. The flow back tank is preferably skid mounted for ease of transport between well sites. Other forms of effluent storage means include tanker trucks and pits. One end of the third line 34c is connected to the first line 34a via a second tee connection 42 intermediate the first tee 38 and the reel connection 22, and the other end 44 is adapted to be coupled to a line leading to the tank 68.

A fourth fluid line 34d should be provided for fluid communication between the second and third lines 34b, 34c for fracturing, pressure reduction and pressure testing purposes. One end of the fourth line 34d is connected to the second line 34b via a third tee connection 46 intermediate points 38, 40, and the other end of the fourth line is connected to the third line 34c via a fourth tee connection 48 intermediate intermediate points 42, 44.

The third line 34c includes at least one choke means for diffusing, or reducing, the energy of fluid passing through the line toward the flow back tank 68. In the preferred embodiment the choke means takes the form of three chokes 50a, 50b and 50c arranged in parallel and located intermediate the fourth tee 48 and the flow back tank, upstream of the third line end 44. The chokes are of different sizes to accommodate different fluid volumes. In this embodiment the smallest choke 50a is a 0.5 inch (about 12.5 mm) diameter choke, choke 50b is of intermediate size at 1.5 inches (about 38 mm) for handling a greater fluid flow than choke 50a, and choke 50c (located between chokes 50a and 50b in this configuration) is the largest in size at 1.75 inches (about 44 mm) for handling the largest fliud flows through the line 34c. It is preferred to have only one choke open at a time, but two or more may be open simultaneously if required to accommodate certain fluid volumes, or if a larger choke is being serviced or malfunctions.

The manifold assembly 30 has an arrangement of valves on the various lines. Some of the valves are “non remote valves”, meaning they are opened and closed manually as required for bleeding excess line pressure. Non remote valves 52a, 52b, 52c are located on the first second and third lines as shown. Other valves on the assembly are “remote” valves, namely they are controlled remotely by a control means such as PLC (programmable logic controller) systems and/or by an operator. The remote valves are arranged as follows:

a first remote “tubing” valve 1 is located along the first line 34a intermediate the first and second tees 38, 42 of the second and third lines 34b, 34c;

a second remote "reel" valve 2 should be located intermediate the second tee 42 and the coiled tubing 20, and in the present embodiment is placed along the extension 36;

a third remote "choke manifold" valve 3 is located along the third line 34c intermediate the second and fourth tees 42, 48;

a fourth remote "annulus" valve 4 is located along the second line 34b intermediate the first and third tees 38, 46;

a fifth remote "crossover" valve 5 is located along the fourth line 34d; and,

sixth to eigth remote "choke" valves 6 to 8 are located at chokes 50a-50c, respectively, to control fluid flow through the respective choke.

The remotely controlled valves should have proximity switches in the valve heads to provide a feedback loop to a control panel, thus notifying an operator when a valve is in a fully open or fully closed position. The control panel should preferably illuminate a valve in red when it is fully closed and in green when fully open, and illuminate in yellow when the valve is in transition between those two positions. The panel should preferably be touch sensitive to allow an operator to touch an illuminated valve to readily switch between open and closed positions.

A number of pressure transducers are located along the assembly 30 to monitor the fluid pressure at that location, such as for disagnostic purposes, as during a pressure test. In this embodiment a first "annulus" pressure transducer 58a is located between the third tee 46 and the end 40 of the second line 34b, and a second pressure transducer 58b is located between the second tee 42 and the reel 18. All of the pressure transducers should be linked with the control means for the assembly 30.

The operation and advatages of the present invention may now be better understood. Once the coiled tubing rig 10 arrives at a well site and is located over the wellbore for insertion of the coiled tubing, the rig is readily prepared for operation by connecting the inlet 32 to applicant's nitrogen pumper, and the ends 40, 44 are connected to the annulus and flow back tank, respectively. An important advantage over existing practice is that no time is wasted in setting up a complex web of piping remote from the rig to form a manifold assembly between several prior art nitrogen pumpers and a coiled tubing rig. Rather, the compact manifold assembly of the present invention is advantageously located on the rig 10 for convenient hook-up and immediate operation.

Once the above connections are made, the remote valves may be set (i.e. opened or closed) to prepare the manifold assembly for one of several desired operations. The remote valve settings for some of the most common operations are set out in fig.8 When the rig is to perform a fracing operation, the following remote valves are opened to form a first fluid route through the manifold assembly: tubing valve 1, reel valve 2, crossover valve 5, and at least one of the choke valves 6-8. The remaining remote valves, namely 3 and 4, are closed. Hence, fluid flowing into the inlet 32 through the check valve 33 is directed through the first line 34a into the coil tubing 20 and down the wellbore into the formation to be fraced. Fluid returning from the formation up the annulus enters the second line 34b at 40, runs through the fourth line 34d into the third line 34c, and is diffused, or "calmed", through one or more of the open chokes 50a-50c before being directed into the flow back tank. The fluid is preferrably nitrogen gas, and may be mixed with a proppant, such as sand, for certain formations. When such a novel and advantageous mixture of gas and proppant is desired, then the applicants' high-pressure injection proppant system (aka "HIPS", the subject of co-pending Canadian patent application 2,508,953) is located upstream of the inlet 32.

When a reverse circulation of fluid through the well is desired for flushing or other purposes, all of the remote valves are opened, except for the tubing and crossover valves 1, 5 which are closed, and one or more of the choke valves 50a-50c are opened to form a second fluid route. Hence, "clean" fluid from the inlet 32 is directed from the first line 34a and through the second line 34b down the annulus. The "dirty" return fluid is forced up the wellbore through the coiled tubing 20, into the first line 34a and then the third line 34c, through one or more of the open chokes 50a-50c, and then toward the flow back tank.

When a "common" coiled tubing operation is desired where the annulus is tied to the coiled tubing to equalize fluid pressures, then the following remote valves are opened to form a third fluid route: tubing valve 1, reel valve 2 and annulus valve 4. All other remote valves are closed. Hence, fluid may move through the coiled tubing 20, the wellbore, the annulus and back to the coiled tubing via the open second line 34b and first line 34a.

When a pressure test ("Ptest") of the manifold assembly is desired, then all of the remote valves are opened to form a fourth fluid route, except for the reel valve 2 and optionally the choke valves 56a-56c.

The manifold assembly also facilitates various desired pressure reductions in the system. For pressure reduction in the annulus, the annulus and choke manifold valves 3 and 4 are closed, the crossover valve 5 is opened, and at least one of the choke valves 6, 7 and 8 are opened, thus allowing fluid to flow from the annulus to the flow back tank. For pressure reduction in the coiled tubing, the tubing, annulus and crossover valves 1, 4, 5 are closed, the choke manifold valve 3 is opened, and at least one of the choke valves 6, 7 and 8 are opened, thus allowing fluid to flow from the coiled tubing to the flow back tank. For system-wide pressure reduction, all of the remote valves should be opened.

The manifold assembly may also facilitate straight fluid flow from the inlet 32 to the flow back tank for flushing purposes by closing the reel, annulus and crossover valves 2, 4, 5, and opening the other remote valves 1, 3, 6, 7 and 8.

Once the rig 10 is finished at a well, the manifold assembly 30 is readily disconnected at points 32, 40 and 44, and the rig and manifold are ready for transport to the next job. The labourious, time consuming and needlessly complex disconnection of prior art manifold piping networks along the ground between a traditional coiled tubing rig and several pumpers is avoided by the present rig and manifold assembly.

Yet another significant advantage of the present invention is that it contributes to a dramatic reduction in the number of vehicles required to service a wellsite. To illustrate, conventional fracing of a coal bed currently requires about 13 or more vehicles for such an operation, including a manifold trailer to transport the numerous components of a conventional manifold assembly to the site. The set up for the fracing operation would include the erection of the elaborate manifold assembly and its connection to several pumpers and bulkers, and then to a coiled tubing unit. The process is needlessly time consuming and costly, and consumes vast space around the well site. In contrast, the applicants' novel method of servicing an underground formation, and in particular fracing a coal bed, requires as few as three vehicles, namely: the coiled tubing rig 10 of the present invention, which includes the novel manifold assembly 30; one of applicants' novel nitrogen pumpers 60 mentioned earlier, upstream of the rig 10 and capable of delivering a sufficient stream of pressurized fluid for the formation being worked; and, the fluid storage means upstream of the pumper 60 in the form of one "super queen" tanker/bulker 62 for supplying the desired fluid. These vehicles are shown in fig. 7. In the preferred embodiment the pumper 60 should be capable of delivering sufficiently pressurized nitrogen gas at about 1800 standard cubic meters per minute (scm/min.), and the bulker 62 should have a nitrogen gas capacity of about 70,000 scm. An effluent reservoir must also be provided downstream of the coiled tubing rig. If such reservoir is in the form of the discussed flow back tank 68, then another vehicle is required to deliver such tank to the well site. A crew truck 64 should also be provided as a source of fuel where the vehicles must operate for extended periods. If proppant is to be mixed into the nitrogen gas stream for the coiled tibing rig 10, then applicants' earlier mentioned HIPS vehicle 66 should be brought to the site and located upstream of the rig 30, but downstream of the nitrogen pumper. Applicants' set up on site is therefore much quicker, requires much less hardware, and takes less space than conventional methods. Disassembly and transport to another site is likewise desireably quick and nimble.

The above description is intended in an illustrative rather than a restrictive sense, and variations to the specific configurations described may be apparent to skilled persons in adapting the present invention to other specific applications. Such variations are intended to form part of the present invention insofar as they are within the spirit and scope of the claims below.

We claim:

1. A servicing rig for a well adapted to communicate with a fluid source and an effluent reservoir, said rig comprising:

a base;

a coiled tubing apparatus on said base for holding and dispensing coiled tubing; and,

a manifold assembly on said base for routing pressurized fluid from said fluid source between said coiled tubing apparatus, said well and said effluent reservoir.

2. The servicing rig of claim 1 wherein said manifold assembly includes means for controlling the flow of said fluid through said assembly to selectively form at least one of a first fluid route to perform fracturing operations, a second fluid route for reverse fluid circulation, a third fluid route for a common coiled tubing operation, and a fourth fluid route for pressure testing.

3. The servicing rig of claim 2 wherein said means for controlling comprises an arrangement of remotely controlled valves and pressure transducers.

4. The servicing rig of claim 2 wherein said first and second fluid routes include means of diffusing energy of said fluid prior to proceeding to said effluent reservoir.

5. The servicing rig of claim 1 wherein said coiled tubing apparatus comprises a rotatable reel mounted on said base for holding and dispensing

coiled tubing and a pivotable mast operatively mounted to said base, said manifold assembly being located intermediate said reel and mast.

6. The servicing rig of claim 1 wherein said base comprises a mobile carrier.

7. A manifold assembly for routing a fluid from a fluid source between a wellbore annulus, an effluent reservoir and a tubing apparatus on a well servicing unit, said assembly comprising:

an inlet for receiving said fluid;

a first line in fluid communication with said inlet and tubing apparatus;

a second line in fluid communication with said first line and said annulus;

a third line in fluid communication with said first line and said effluent reservoir;

a fourth line in fluid communication between said second and third lines;

wherein said first, second, third and fourth lines are adapted for location on said well servicing unit.

8. The manifold assembly of claim 7 further comprising means for controlling the flow of said fluid through said assembly to selectively form at least one of a first fluid route to perform fracturing operations, a second fluid route for reverse fluid circulation, a third fluid route for a common coiled tubing operation, and a fourth fluid route for pressure testing.

9. The manifold assembly of claim 8 wherein said means for controlling includes a first remotely controlled valve located on said first line intermediate said second and third lines, a second remotely controlled valve on said first line downstream of said third line, a third remotely controlled valve located on said

third line intermediate said first and fourth lines, a fourth remotely controlled valve located on said second line intermediate said first and fourth lines, and a fifth remotely controlled valve on said fourth line.

10. The manifold assembly of claim 7 wherein said third line includes choke means for diffusing fluid energy prior to entering said effluent reservoir.

11. The manifold assembly of claim 8 wherein said third line includes choke means for diffusing fluid energy prior to entering said effluent reservoir.

12. The manifold assembly of claim 9 wherein said third line includes at least one choke downstream of said fourth line for diffusing fluid energy prior to entering said effluent reservoir, and wherein said means for controlling further includes further remotely controlled valves for each choke.

13. A method of servicing an underground formation comprising:

providing a fluid storage means;

providing a fluid pumping means capable of drawing fluid from said fluid storage means and supplying a sufficient fluid stream under sufficient pressure for servicing said underground formation;

providing a coiled tubing unit for receiving and introducing said fluid stream into said underground formation, said unit having a manifold assembly for routing and controlling said fluid stream between said unit and said underground formation; and,

providing an effluent reservoir for receiving fluid from said manifold assembly.

14. The method of claim 13 wherein said fluid comprises nitrogen gas.

15. The method of claim 14 further comprising introducing proppant into said nitrogen gas prior to being received by said coiled tubing unit.

16. The method of claim 15 wherein said proppant comprises sand.

17. The method of claim 15 comprising providing a high-pressure injection proppant system for introducing said proppant upstream of said coiled tubing unit and downstream of said pumper.

18. The method of claim 13 comprising providing a crew truck for supplying fuel to said pumper and coiled tubing unit.

19. The method of claim 13 wherein said coiled tubing unit includes a tubing apparatus and communicates withan effluent reservoir, and said manifold assembly comprises:

an inlet for receiving said fluid stream;

a first line in fluid communication with said inlet and said tubing apparatus;

a second line in fluid communication with said first line and said underground formation;

a third line in fluid communication with said first line and said effluent reservoir; and,

a fourth line in fluid communication between said second and third lines.

20. The method of claim 13 wherein said manifold assembly includes means for controlling the flow of said fluid stream through said assembly to selectively

form at least one of a first fluid route to perform fracturing operations, a second fluid route for reverse fluid circulation, a third fluid route for a common coiled tubing operation, and a fourth fluid route for pressure testing.

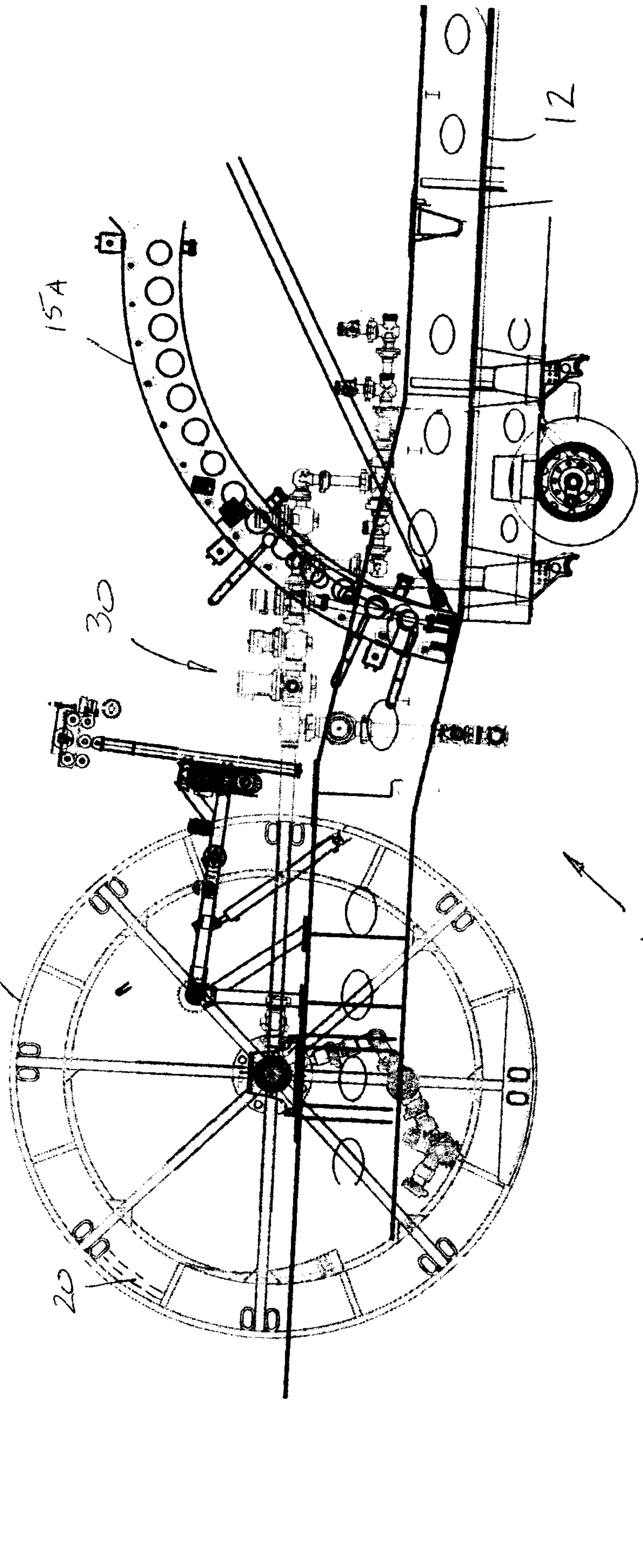


Fig. 1

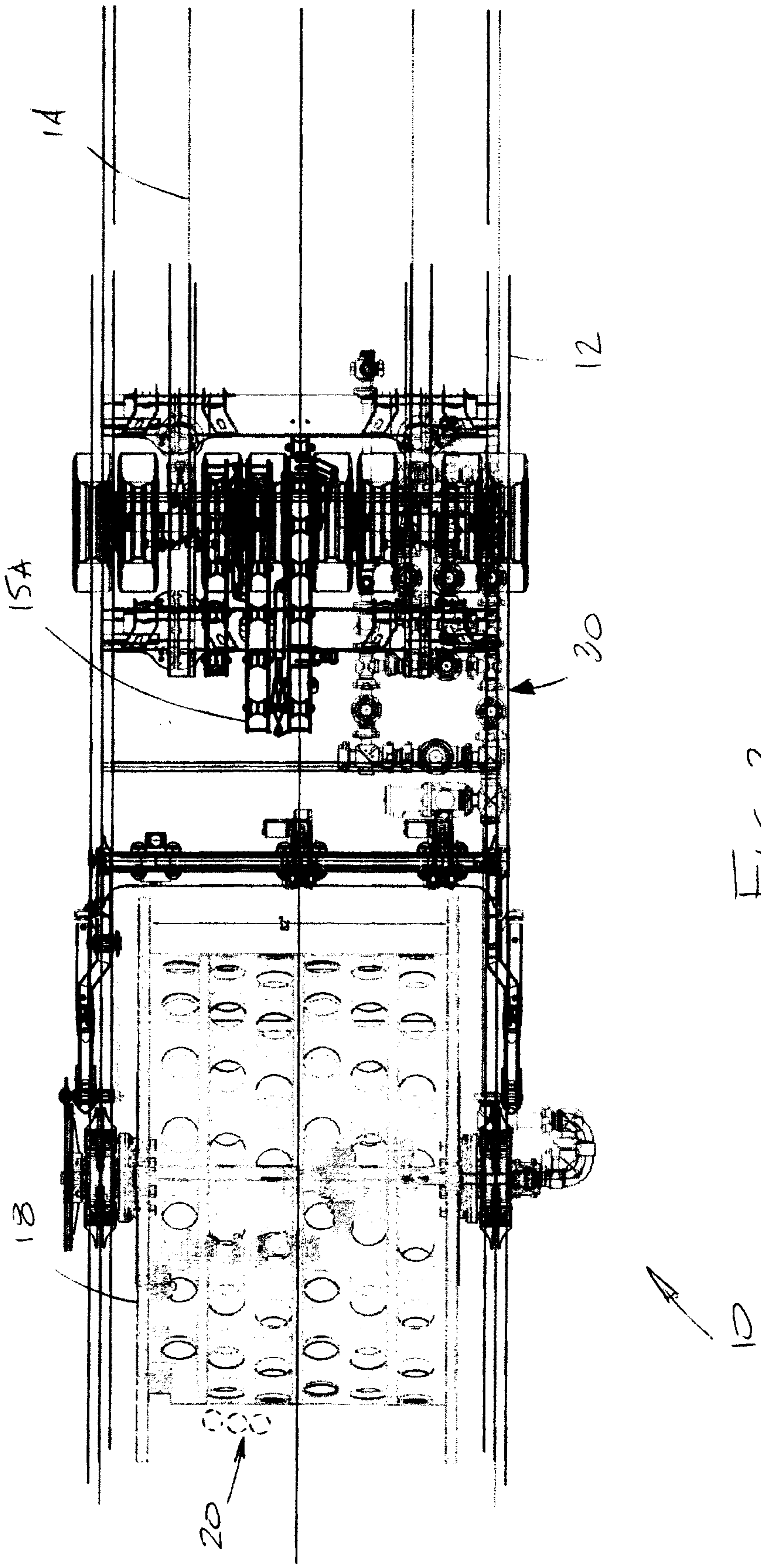


FIG. 2

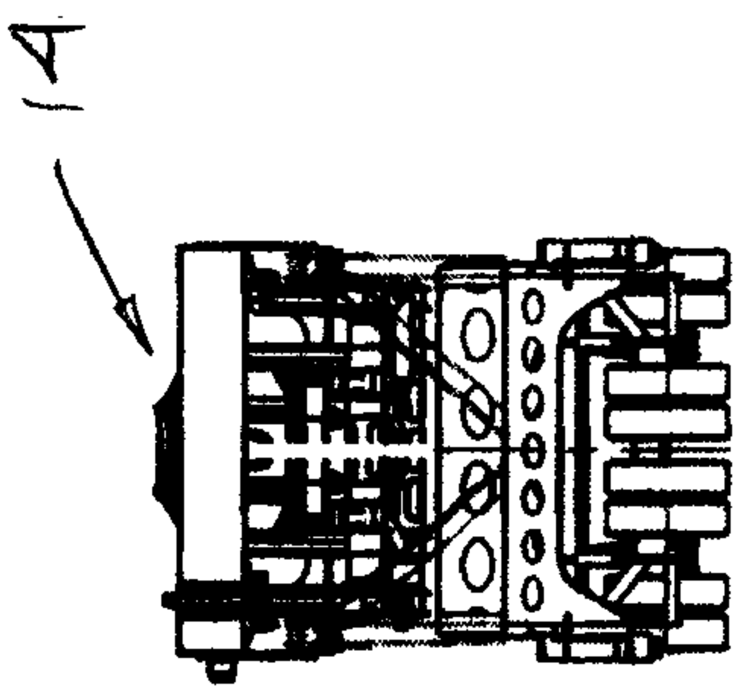


FIG. 3B

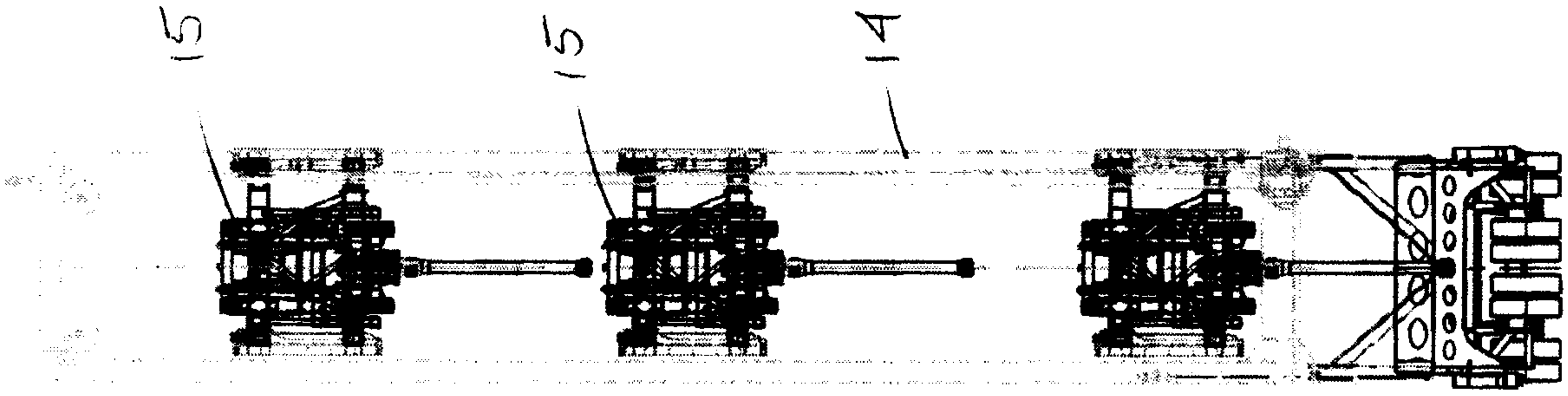


FIG. 3A

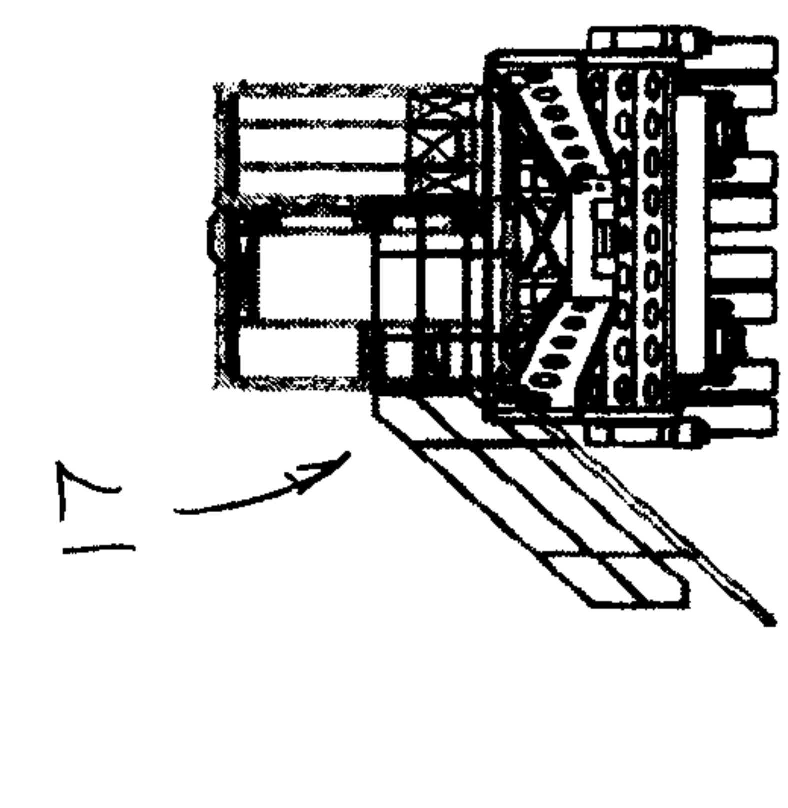


FIG. 3C

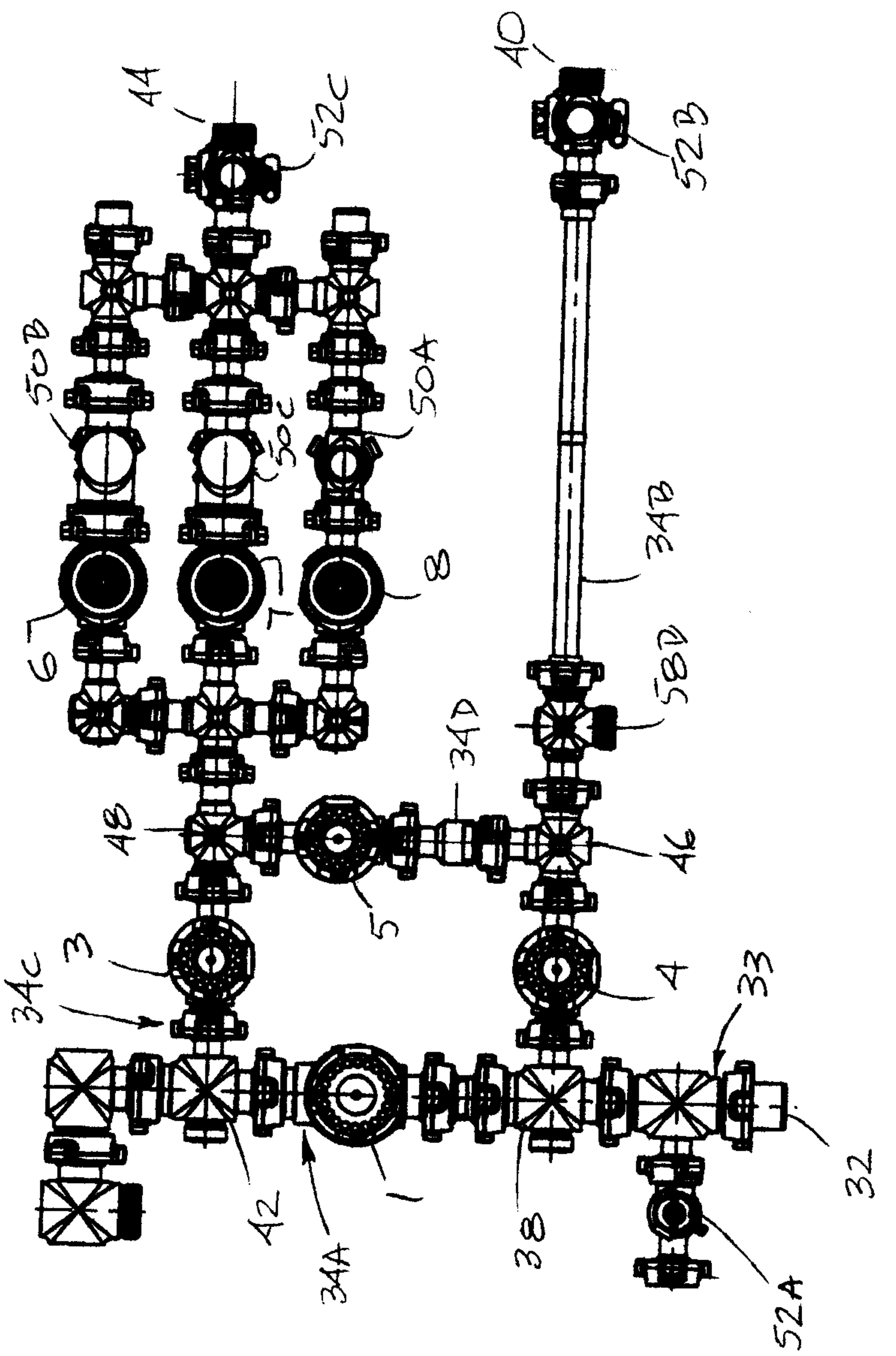

44
52C
40
52B
50B
50C
50A
34B
6
7
8
58D
34D
48
46
5
3
34C
4
33
42
34A
1
38
32
52A

FIG. 4

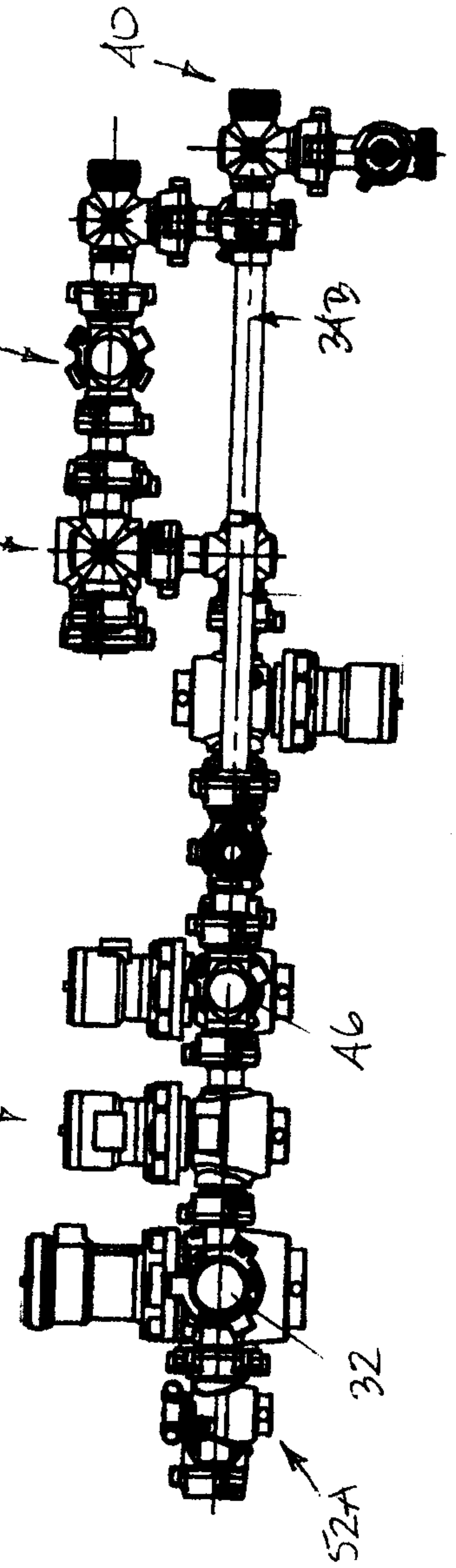

40
50A
34B
8
46
4
32
52A

FIG. 5

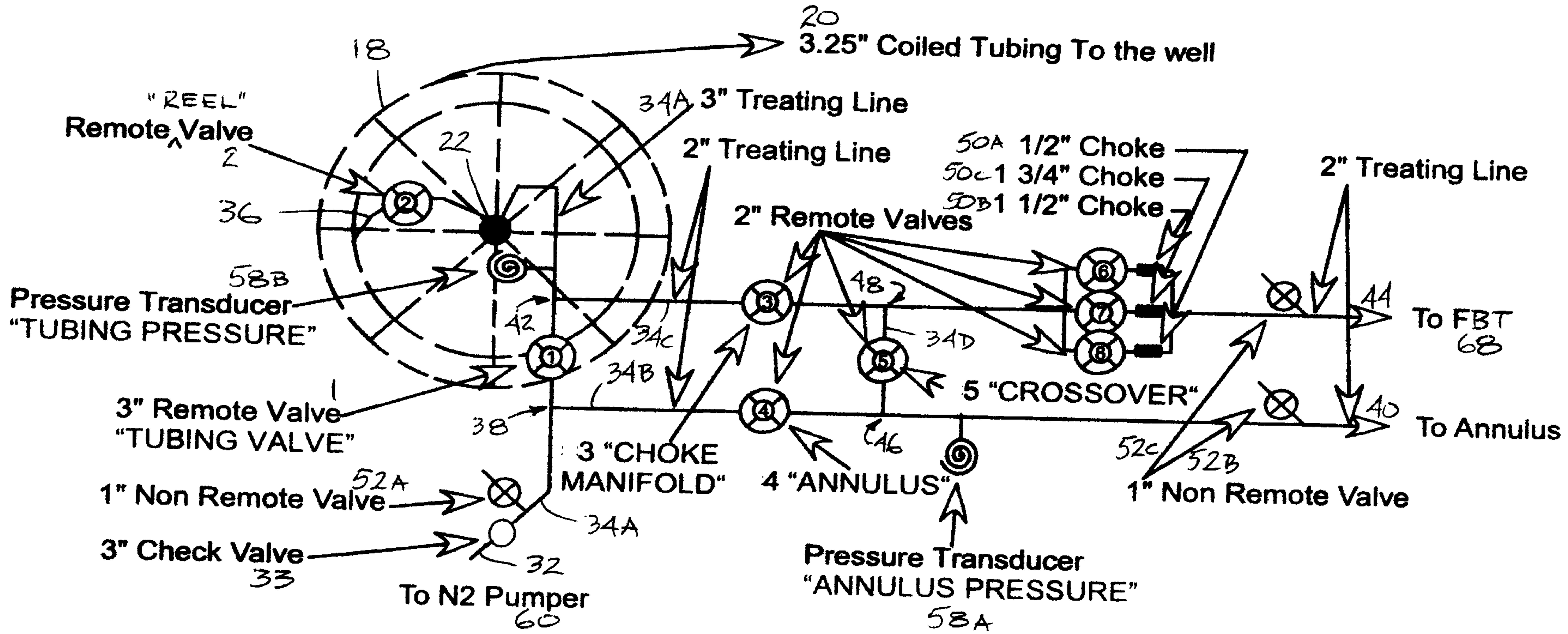

20
3.25" Coiled Tubing To the well
18
"REEL"
Remote Valve
2
22
36
34A 3" Treating Line
2" Treating Line
58B
Pressure Transducer
"TUBING PRESSURE"
42
34C
34B
1
3" Remote Valve
"TUBING VALVE"
38
3 "CHOKE
MANIFOLD"
52A
1" Non Remote Valve
34A
3" Check Valve
33
32
To N2 Pumper
60
2" Remote Valves
48
34D
5 "CROSSOVER"
46
4 "ANNULUS"
Pressure Transducer
"ANNULUS PRESSURE"
58A
50A 1/2" Choke
50C 1 3/4" Choke
50B 1 1/2" Choke
2" Treating Line
44
To FBT
68
40
To Annulus
52C
52B
1" Non Remote Valve

FIG. 6

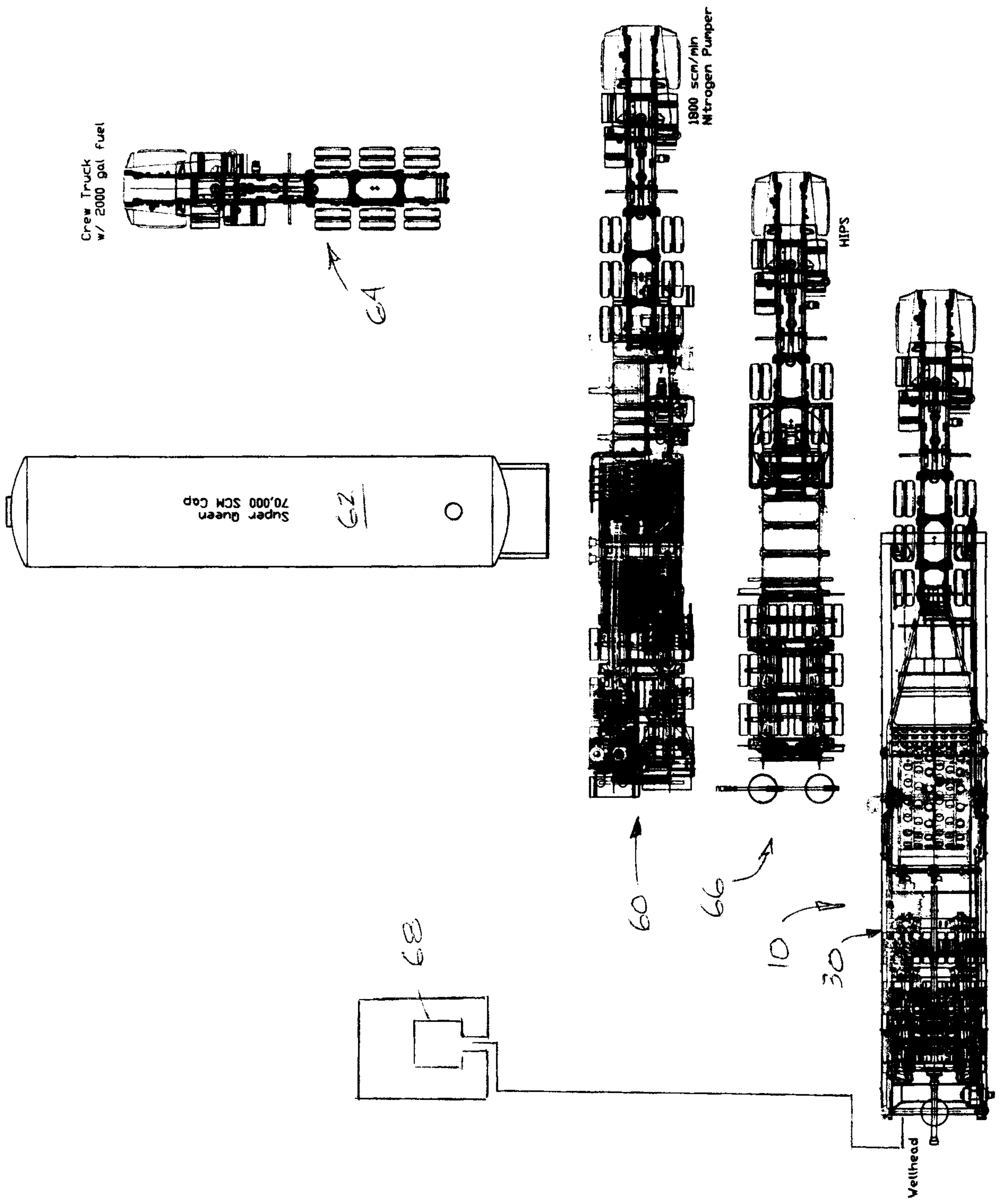

Crew Truck
w/ 2000 gal fuel
64
Super Queen
70,000 SCM Cap
62
1800 scm/min
Nitrogen Pumper
HIPS
60
66
10
30
68
Wellhead

FIG. 7

X = Closed
O = Open

Valve Number	Fracing	Rev Circ	Common	Ptest	Valve Name
1	O	X	O	O	Tubing
2	O	O	O	X	Reel
3	X	O	X	X	Choke Manifold
4	X	O	O	X	Annulus
5	O	X	X	O	Crossover
6	O	O	O	O	Choke 1
7	O	O	O	O	Choke 2
8	O	O	O	O	Choke 3

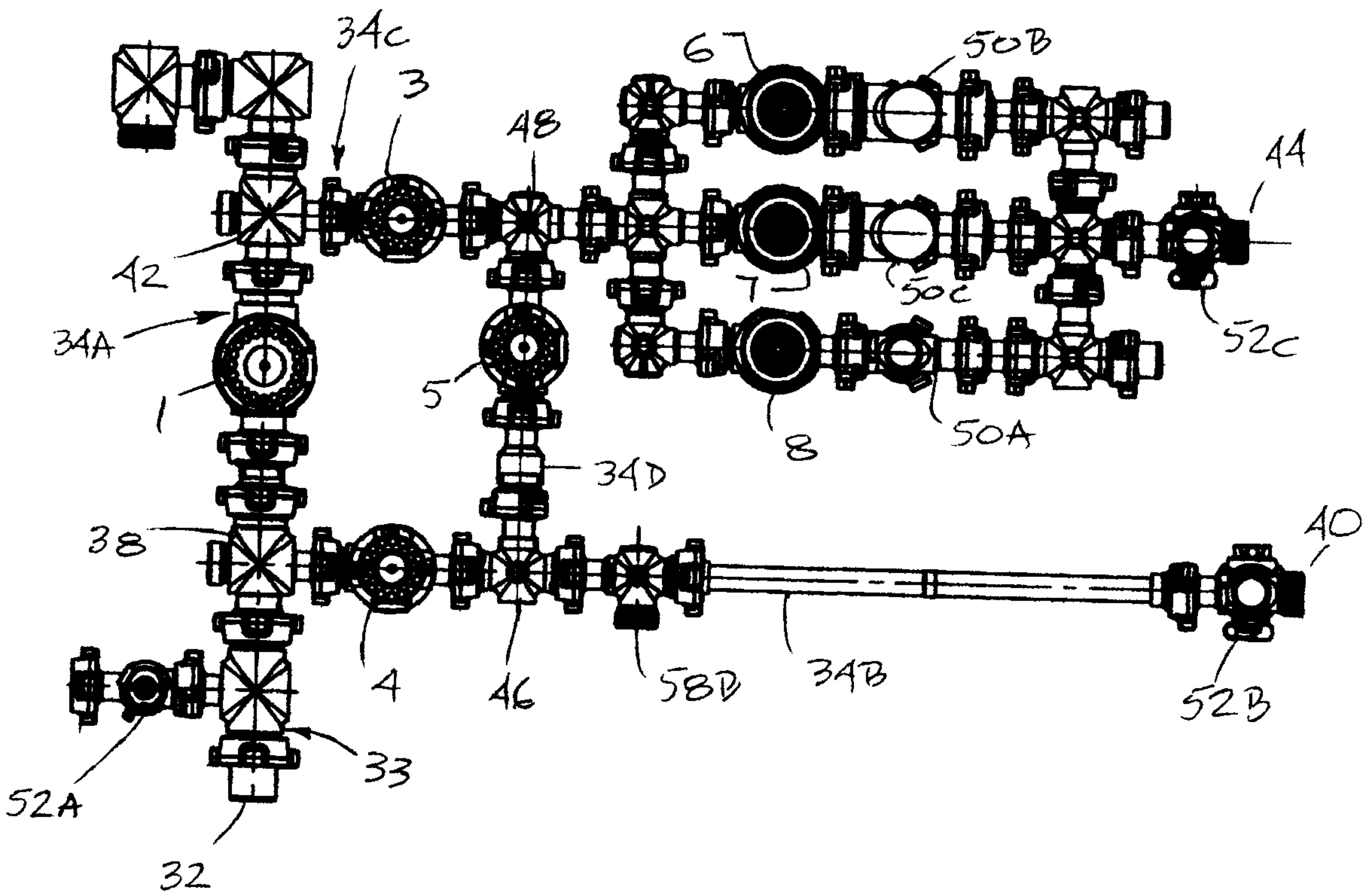
FIG. 8

Applicant: Frac Source Inc.

Title: Well Servicing Rig and Manifold Assembly

Agent: Thomas E. Malyszko, agent no. 4274, Tel. (403) 540-3204

Docket No.: 282.3



34c
3
6
50B
48
44
42
34A
1
5
7
50c
52c
8
50A
34D
38
40
4
46
58D
34B
52B
52A
33
32