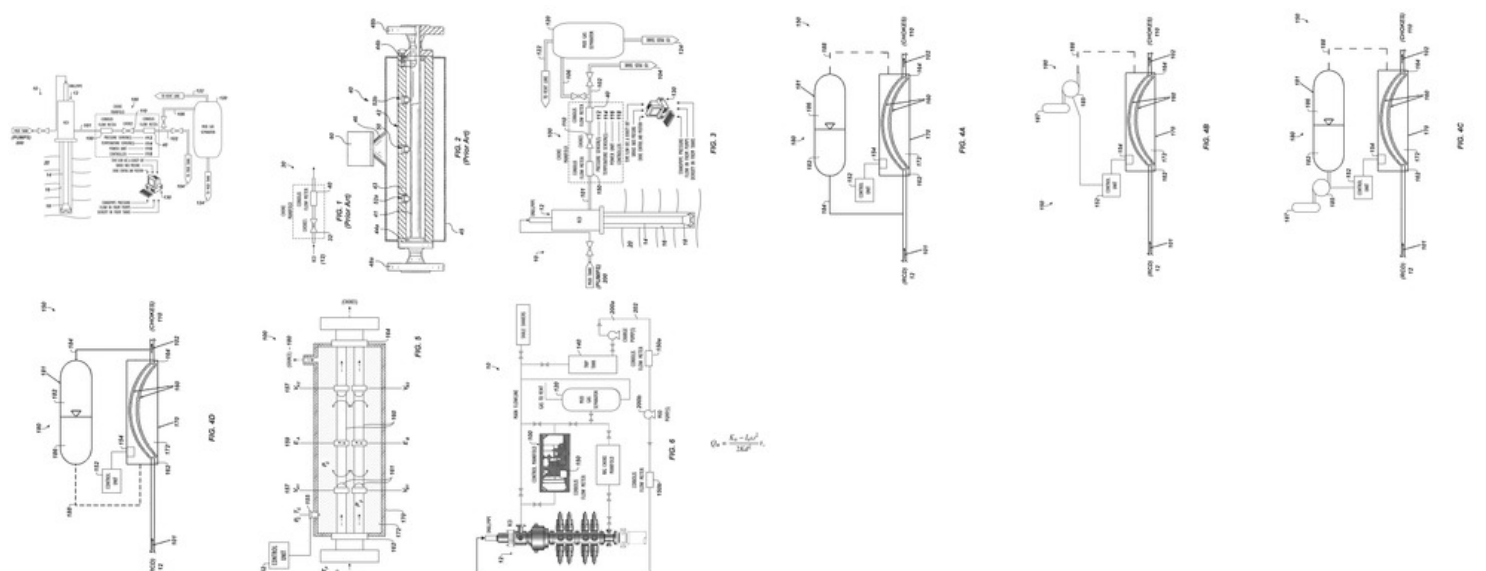
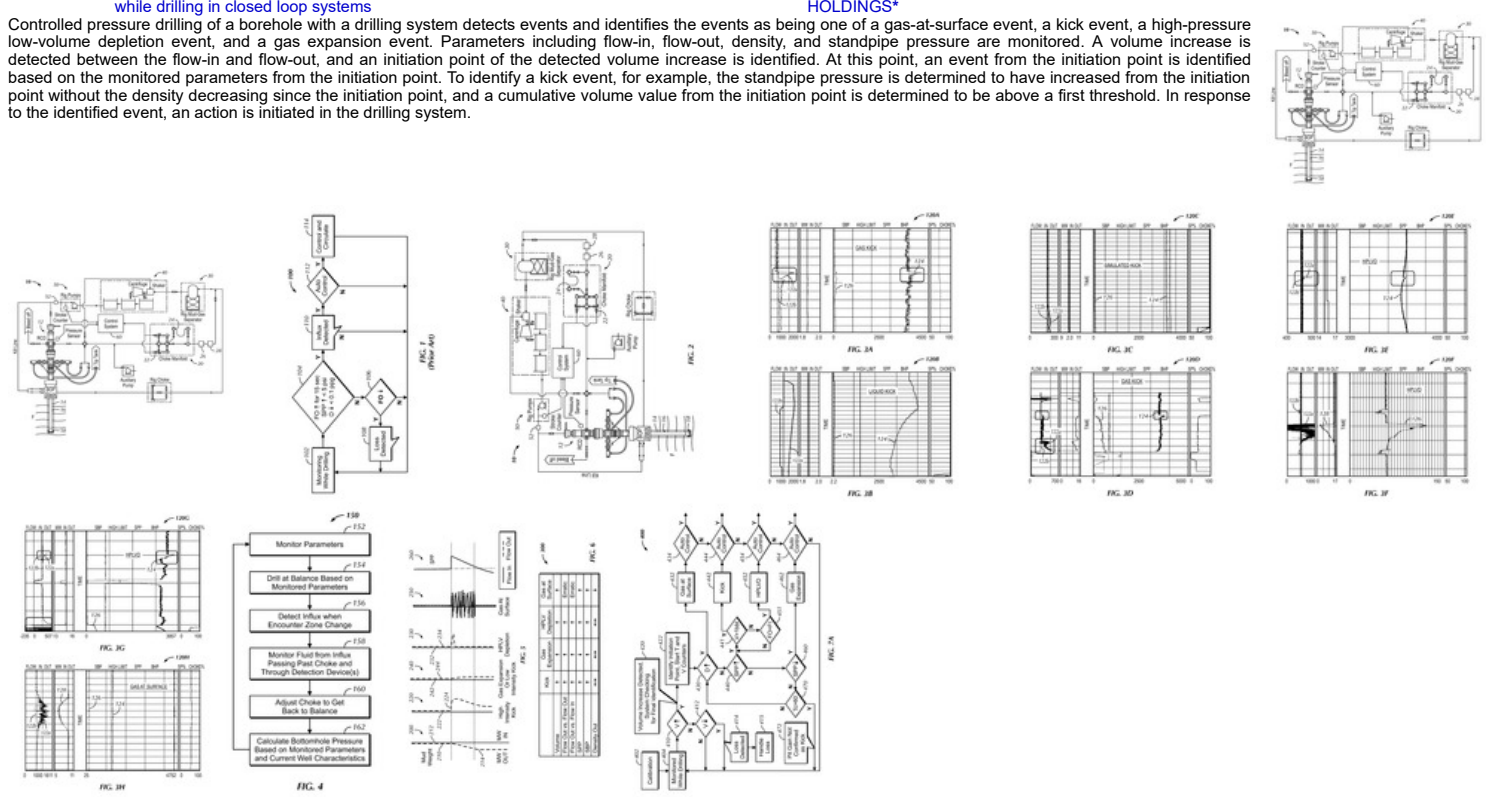
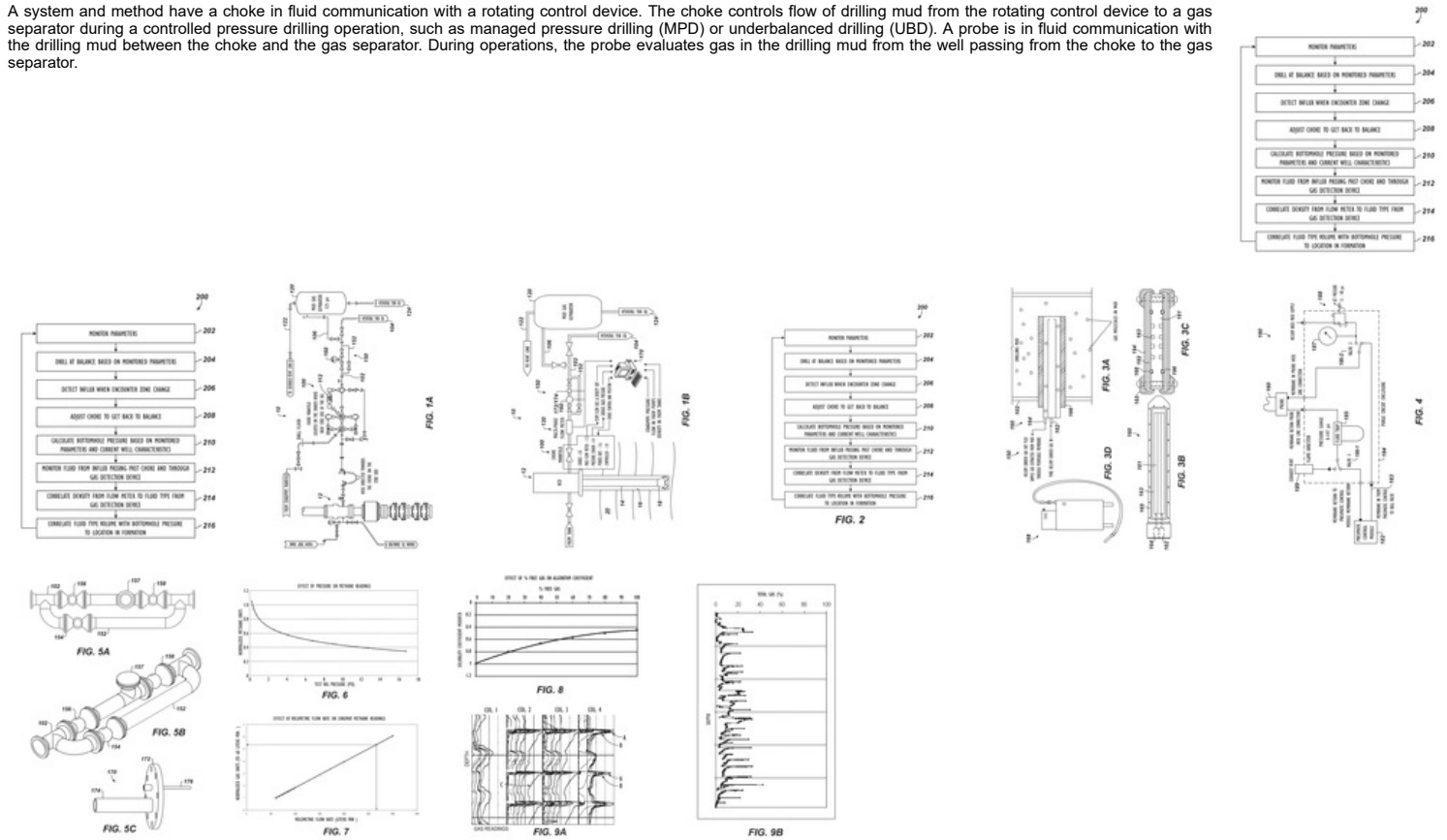


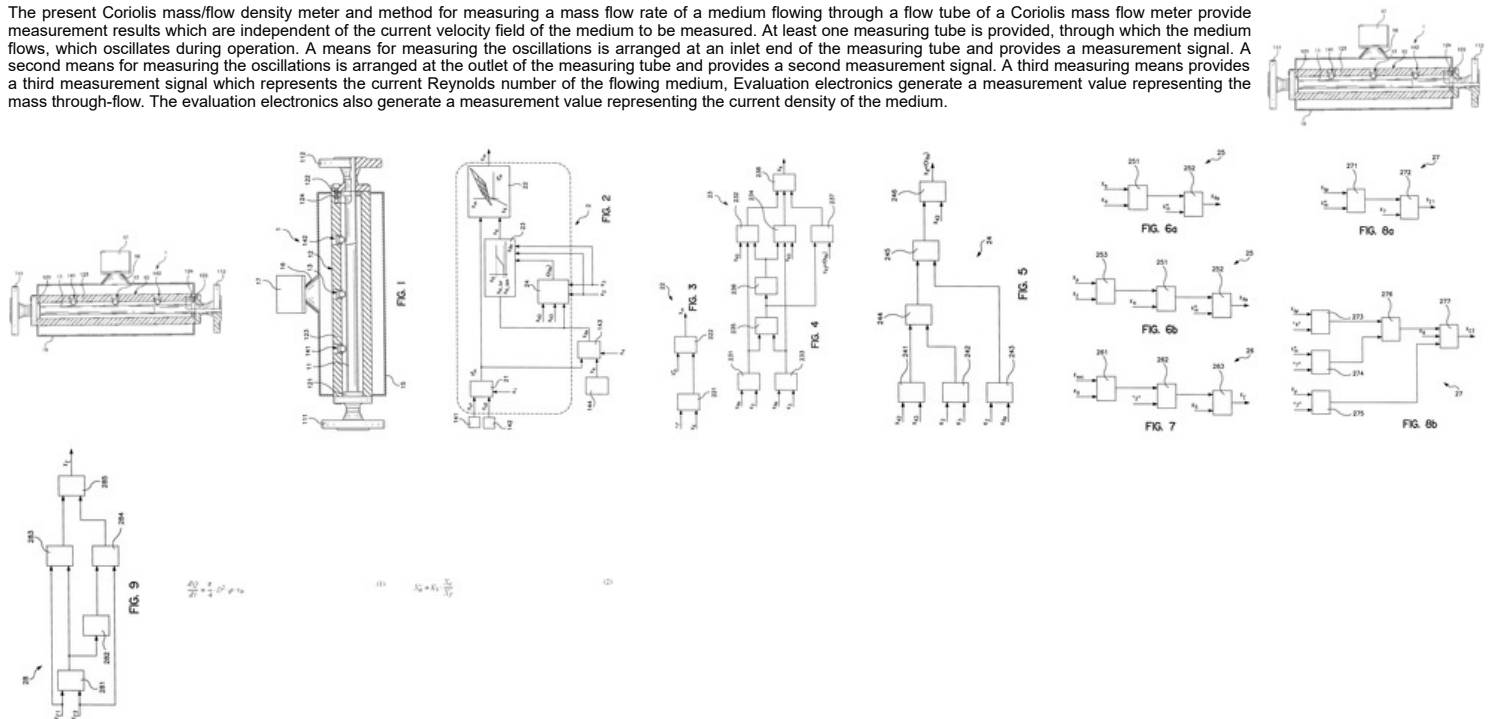
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#	Title	Publication number	1st app. date	Applicant/Assignee	1st publ. date	Publ. date
1.	Coriolis flow meter having flow tube with equalized pressure differential	CA2961388	2015-09-21	WEATHERFORD LAMB WEATHERFORD TECHNOLOGY HOLDINGS*	2016-03-24	2016-03-24
A Coriolis flow meter for a drilling system measures flow from a wellbore and/or from at least one pump into the wellbore. The meter can be disposed upstream of at least one choke used for controlling backpressure, and/or the meter can be disposed between at least one pump and the wellbore. The meter has at least one flow tube adapted to vibrate and conducts the flow at a first pressure level from an inlet side to an outlet side. A vessel encloses the at least one flow tube at least between the inlet and outlet sides and holds a second pressure level therein about the at least one flow tube. The second pressure level can be equal to or nearly equal to the first pressure level to reduce or nearly eliminate a pressure differential across the at least one flow tube. For example, the second pressure level can be elevated above environmental relative to the first pressure level to reduce a pressure differential across the at least one flow tube. Alternatively, the second pressure level can be less than the first pressure level.						
						
2.	Automatic event detection and control while drilling in closed loop systems	US20160245027	2015-02-23	WEATHERFORD TECHNOLOGY HOLDINGS*	2016-08-25	2016-08-25
Controlled pressure drilling of a borehole with a drilling system detects events and identifies the events as being one of a gas-at-surface event, a kick event, a high-pressure low-volume depletion event, and a gas expansion event. Parameters including flow-in, flow-out, density, and standpipe pressure are monitored. A volume increase is detected between the flow-in and flow-out, and an initiation point of the detected volume increase is identified. At this point, an event from the initiation point is identified based on the monitored parameters from the initiation point. To identify a kick event, for example, the standpipe pressure is determined to have increased from the initiation point without the density decreasing since the initiation point, and a cumulative volume value from the initiation point is determined to be above a first threshold. In response to the identified event, an action is initiated in the drilling system.						
						

A system and method have a choke in fluid communication with a rotating control device. The choke controls flow of drilling mud from the rotating control device to a gas separator during a controlled pressure drilling operation, such as managed pressure drilling (MPD) or underbalanced drilling (UBD). A probe is in fluid communication with the drilling mud between the choke and the gas separator. During operations, the probe evaluates gas in the drilling mud from the well passing from the choke to the gas separator.



The present Coriolis mass/flow density meter and method for measuring a mass flow rate of a medium flowing through a flow tube of a Coriolis mass flow meter provide measurement results which are independent of the current velocity field of the medium to be measured. At least one measuring tube is provided, through which the medium flows, which oscillates during operation. A means for measuring the oscillations is arranged at an inlet end of the measuring tube and provides a measurement signal. A second means for measuring the oscillations is arranged at the outlet of the measuring tube and provides a second measurement signal. A third measuring means provides a third measurement signal which represents the current Reynolds number of the flowing medium. Evaluation electronics generate a measurement value representing the mass through-flow. The evaluation electronics also generate a measurement value representing the current density of the medium.



5.

Controlled pressure drilling system with flow measurement and well control

US20160138351

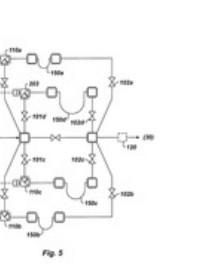
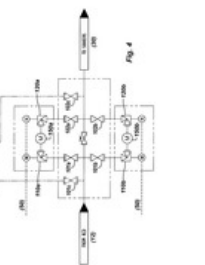
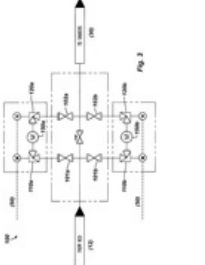
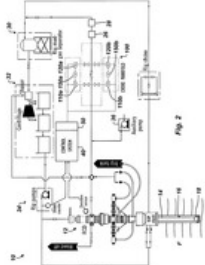
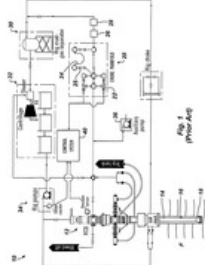
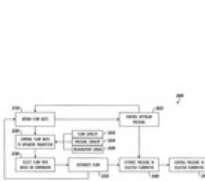
2015-11-17

WEATHERFORD TECHNOLOGY HOLDINGS*

2016-05-19

2016-05-19

A drilling system for drilling a wellbore has one or more valves or chokes to control the upstream pressure of drilling fluid flow in a controlled pressure drilling operation. A measurement is obtained of the drilling fluid flow from the wellbore. Based on the obtained measurement, the drilling fluid flow is selectively distributed with a distributor through one or more of a plurality of flowmeters, such as Coriolis meters. A reading of the drilling fluid flow is obtained from the selected flowmeter (s). Upstream pressure in the drilling fluid flow is controlled with the one or more valve based at least in part on the reading from the one or more selected flowmeters. The reading can be a flow rate, a pressure, or the like compared to capacities of the flowmeters. Additional valves downstream of the flowmeters can be controlled based on cavitation that the valves are estimated to produce.



6.

A majority component proportion determination of a fluid using a coriolis flowmeter

WO03021204

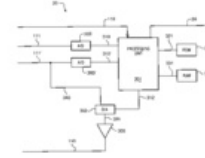
2001-08-29

MAJKRO MOUSHN INK MICRO MOTION*

2003-03-13

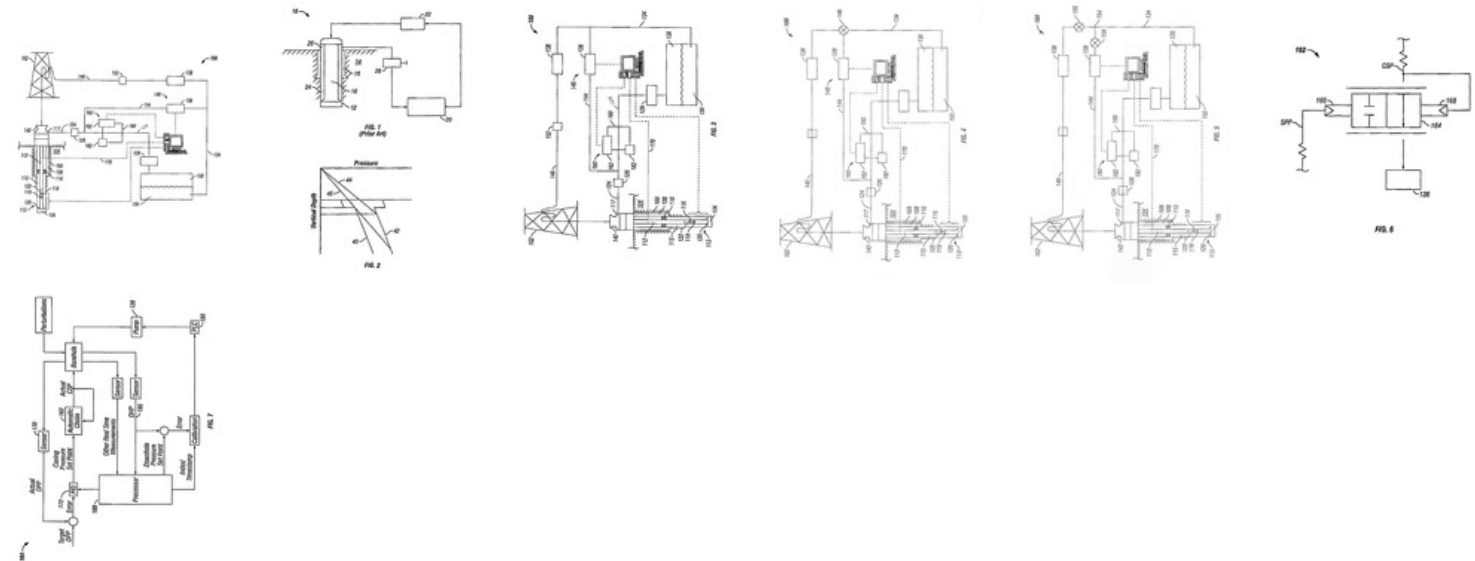
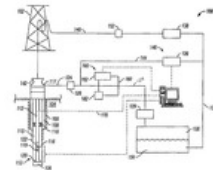
2003-03-13

A method, circuitry and a software product for use with a Coriolis flowmeter. Pickoff signals and a temperature signal are received from the Coriolis flowmeter, the pickoff signals are processed to determine a measured density of the fluid flowing through the Coriolis flowmeter, the temperature signal is processed to determine a temperature-varying density, and the measured density is divided by the temperature-varying density to determine the purity of the fluid.



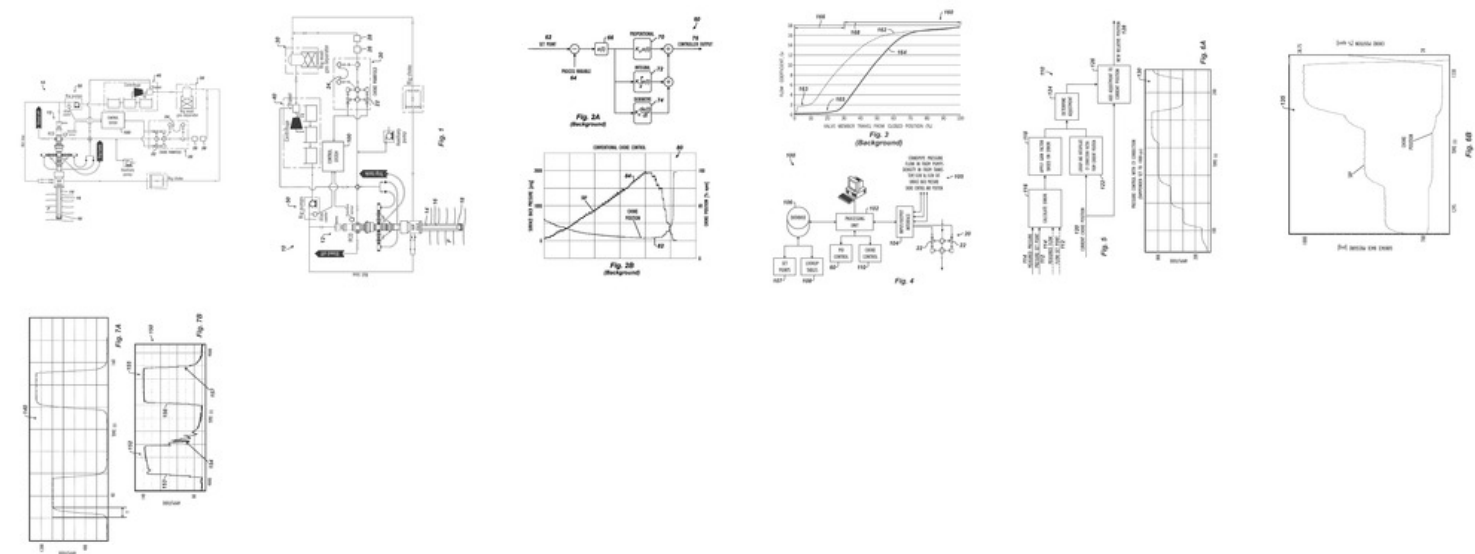
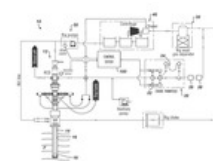
7.	Method and apparatus for controlling bottom hole pressure in a subterranean formation during rig pump operation	WO2008051978	2007-10-23	M-I LLC* MI SMITH INTERNATIONAL*	2008-05-02	2008-05-02
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A method for maintaining pressure in a wellbore during drilling operations is disclosed. The method includes the steps of providing fluid from a reservoir through a drill string, circulating the fluid from the drill string to an annulus between the drill string and the wellbore, isolating pressure in the annulus, measuring pressure in the annulus, calculating a set point backpressure, applying back pressure to the annulus based on the set point back pressure, diverting fluid from the annulus to a controllable choke, controllably bleeding off pressurized fluid from the annulus, separating solids from the fluid, and directing the fluid back to the reservoir. An apparatus for maintaining pressure in a wellbore during drilling operations that includes an adjustable choke for controllably bleeding off pressurized fluid from the wellbore annulus, a backpressure pump for applying a calculated set point backpressure, and a processor for controlling the adjustable choke and backpressure pump is also disclosed.

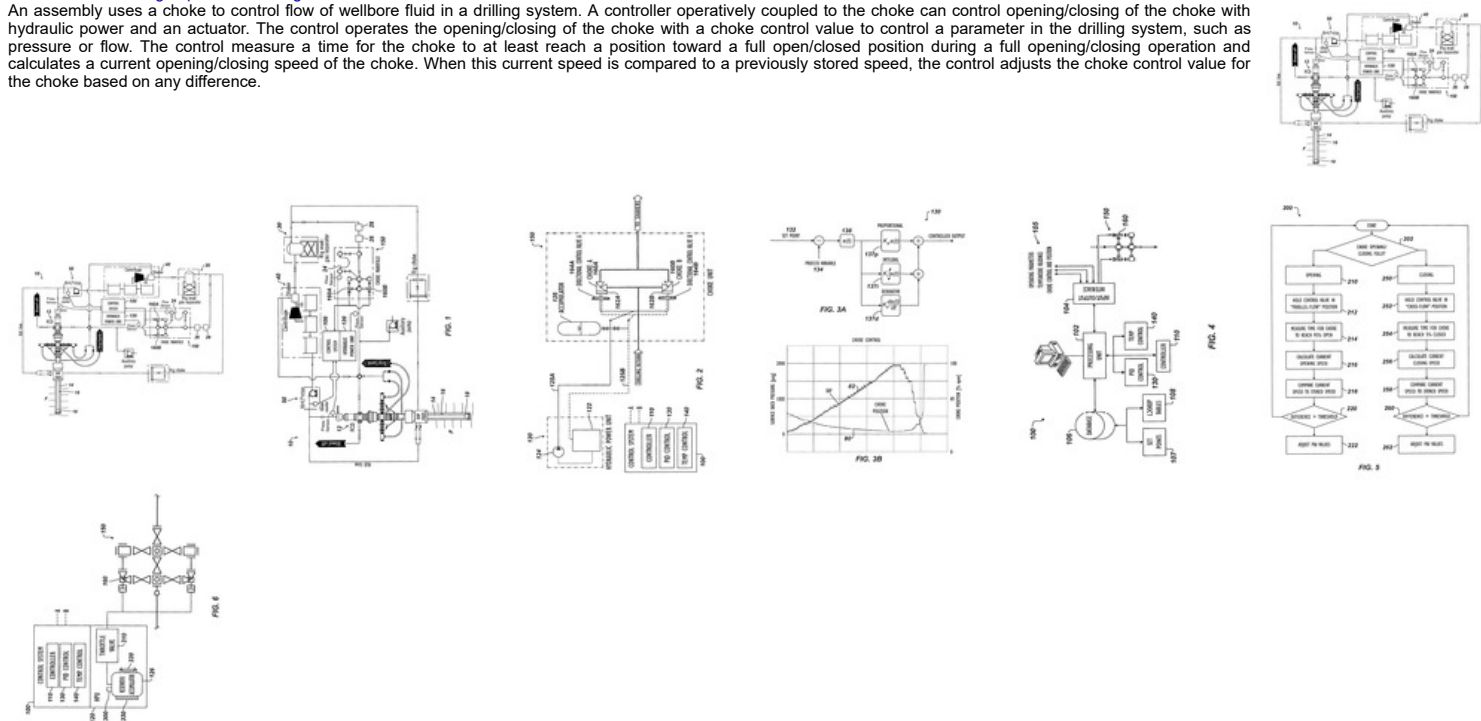


8.	Choke control tuned by flow coefficient for controlled pressure drilling	CA2963668	2015-10-06	WEATHERFORD TECHNOLOGY HOLDINGS*	2016-04-14	2016-04-14
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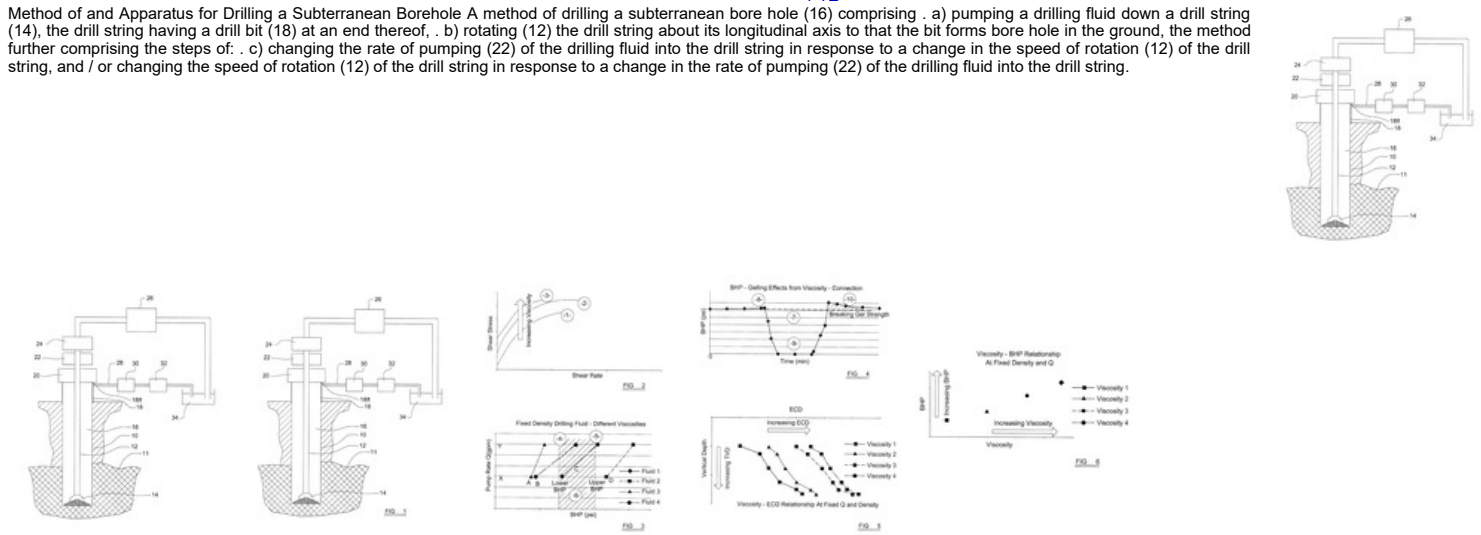
A computerized control is used in controlling a choke when drilling a wellbore with a drilling system. The computerized control obtains a measured value of a parameter in the drilling system and controls the parameter in the drilling system using the choke. The computerized control obtains indications of an error between a set point of the parameter and the measured value of the parameter in the drilling system, a flow coefficient character of the choke, and a current position of the choke. Based on these indications, the computerized control then determines a position adjustment for the choke and adjusting the parameter in the drilling system by applying the position adjustment to the choke.



An assembly uses a choke to control flow of wellbore fluid in a drilling system. A controller operatively coupled to the choke can control opening/closing of the choke with hydraulic power and an actuator. The control operates the opening/closing of the choke with a choke control value to control a parameter in the drilling system, such as pressure or flow. The control measure a time for the choke to at least reach a position toward a full open/closed position during a full opening/closing operation and calculates a current opening/closing speed of the choke. When this current speed is compared to a previously stored speed, the control adjusts the choke control value for the choke based on any difference.



Method of and Apparatus for Drilling a Subterranean Borehole A method of drilling a subterranean bore hole (16) comprising . a) pumping a drilling fluid down a drill string (14), the drill string having a drill bit (18) at an end thereof, . b) rotating (12) the drill string about its longitudinal axis so that the bit forms bore hole in the ground, the method further comprising the steps of: . c) changing the rate of pumping (22) of the drilling fluid into the drill string in response to a change in the speed of rotation (12) of the drill string, and / or changing the speed of rotation (12) of the drill string in response to a change in the rate of pumping (22) of the drilling fluid into the drill string.





13.

High temperature drive system for a coriolis mass flowmeter

US5987998

1998-08-26

MAJKRO MOUSHN INK
MICRO MOTION*

1999-11-23

1999-11-23

A drive system (104) for use in a high temperature environment. The drive system (104) is made of materials that can withstand high temperatures without degrading. There are no plastics or epoxy adhesives used in this drive system (104). The drive system is also made more efficient by placing the drive system on a flow tube outside of a loop in the flow tube between the inlet and the outlet.

14.

Method for generating a diagnostic from a deviation of a flow meter parameter

CA2895864

2008-05-01

MICRO MOTION*

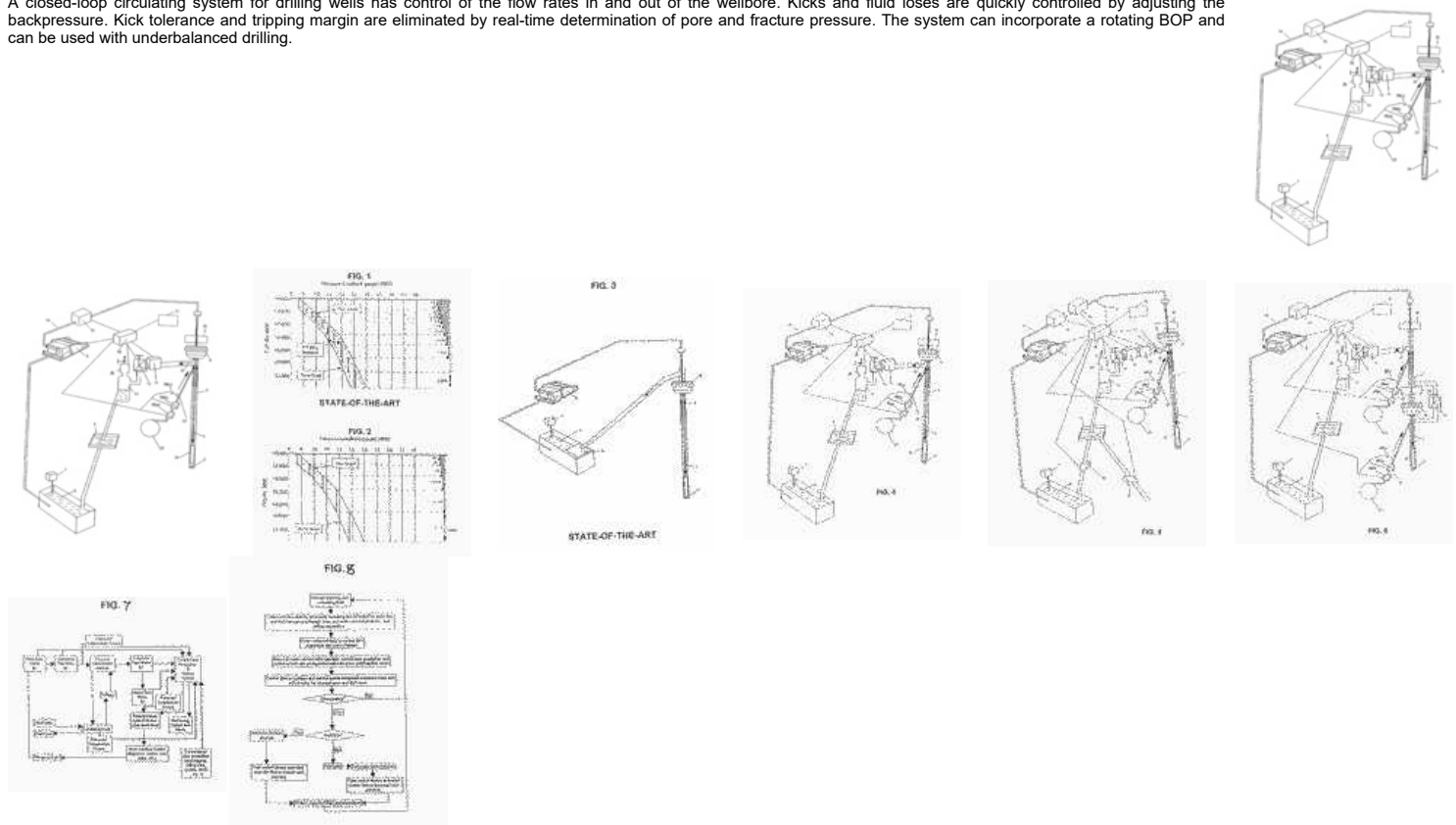
2009-11-05

2009-11-05

A method for detecting a deviation in a flow meter parameter of a flow meter that is adapted to measure a fluid flow rate is provided. The method comprises measuring a differential pressure across at least a portion of the flow meter. The method further comprises comparing the measured differential pressure to an expected differential pressure; the expected differential pressure being based on the measured flow rate. The method further comprises detecting a deviation in the flow meter parameter if the difference between the measured differential pressure and the expected differential pressure exceeds a threshold limit.

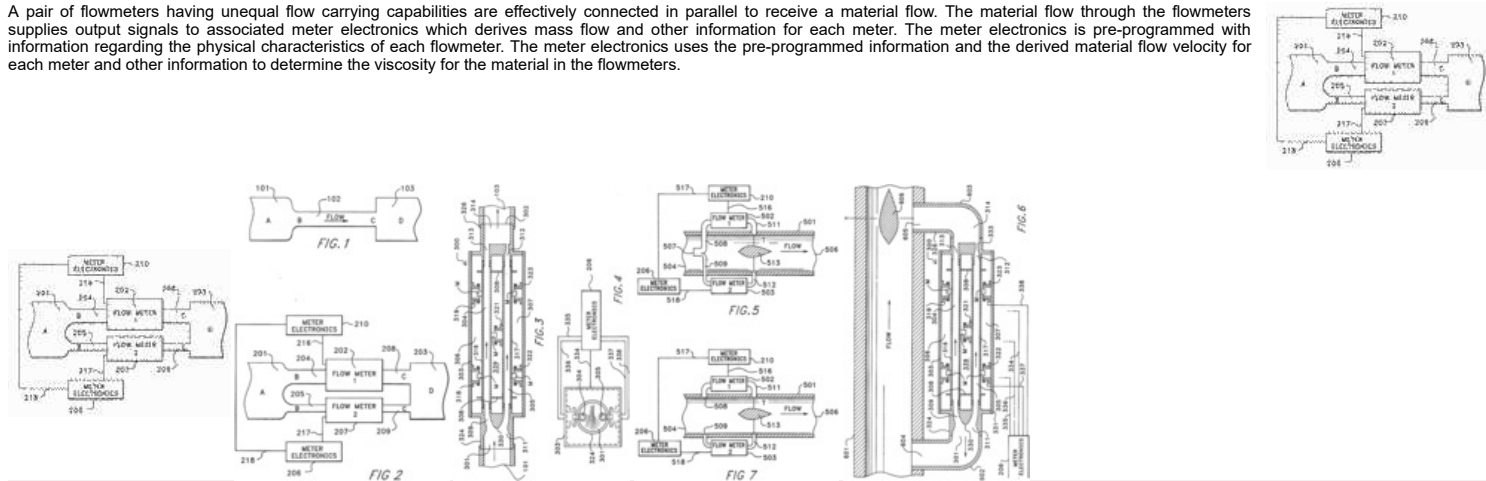
16.	Closed loop fluid-handling system for well drilling	WO200250398	2000-12-18	IMPACT ENGINEERING SOLUTIONS IMPACT ENGINEERING SOLUTIONS L IMPACT SOLUTIONS SECURE DRILLING INTERNATIONAL* SECURE DRILLING INTERNATIONAL B	2002-06-27	2002-06-27
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A closed-loop circulating system for drilling wells has control of the flow rates in and out of the wellbore. Kicks and fluid losses are quickly controlled by adjusting the backpressure. Kick tolerance and tripping margin are eliminated by real-time determination of pore and fracture pressure. The system can incorporate a rotating BOP and can be used with underbalanced drilling.

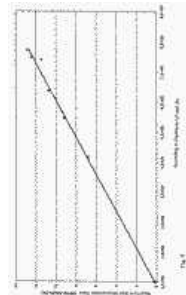
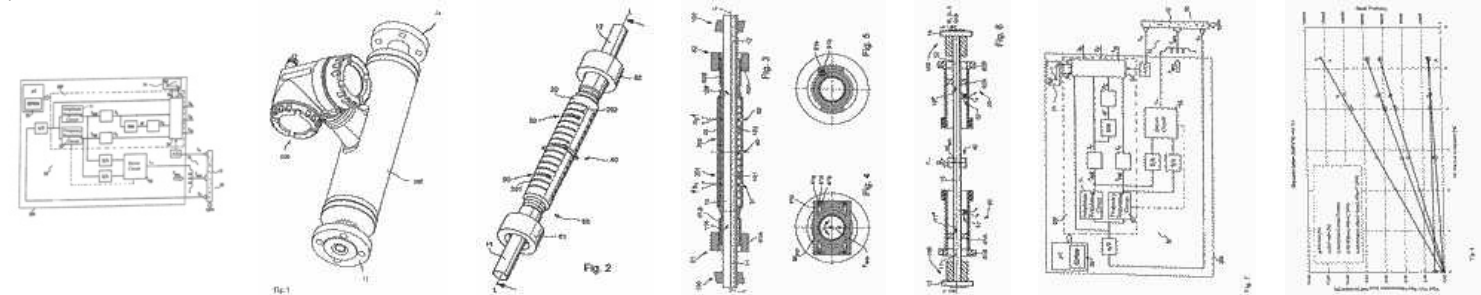


17.	Coriolis viscometer using parallel connected coriolis mass flowmeters	US5661232	1996-03-06	MICRO MOTION*	1997-08-26	1997-08-26
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A pair of flowmeters having unequal flow carrying capabilities are effectively connected in parallel to receive a material flow. The material flow through the flowmeters supplies output signals to associated meter electronics which derives mass flow and other information for each meter. The meter electronics is pre-programmed with information regarding the physical characteristics of each flowmeter. The meter electronics uses the pre-programmed information and the derived material flow velocity for each meter and other information to determine the viscosity for the material in the flowmeters.



The inventive in-line-measuring device comprises a vibratory-type measuring sensor provided with at least one measuring tube through which a measurable medium passes during the device operation. Said measuring tube is displaceable by means of an exciter arrangement at least temporarily and/or at least in a parallel direction according to lateral oscillations and at least temporarily and/or at least in a parallel direction according to torsion oscillations around the longitudinal imaginary axis of the measuring tube alternating with lateral oscillations or temporary superimposed therewith. In addition, the in-line-measuring device comprises a sensor arrangement for producing the measuring tube oscillations corresponding to representative oscillation measurements. An electronic unit of the measuring device, which controls the exciter arrangement, generates, by means of the oscillation measuring signal an/or an excitation current at least temporary at least one measuring value representing at least one measurable physical measuring quantity, par example mass flow rate-mass flow rate, a medium density or viscosity. Said electronic unit of the measuring device also makes it possible to determine a first intermediate value which corresponds to the lateral current fraction of the excitation current for maintaining the lateral oscillations of the measuring tube and a second intermediate value corresponding to the torsion current value of the excitation current for maintaining the torsion oscillations of the measuring tube and/or to a torsion oscillation damping of the measuring tube. A high-accuracy value is determined taking into account said two intermediate values and is valid event for two- or more-phased media.



21.

Drive circuit modal filter for a vibrating tube flowmeter

WO9902945

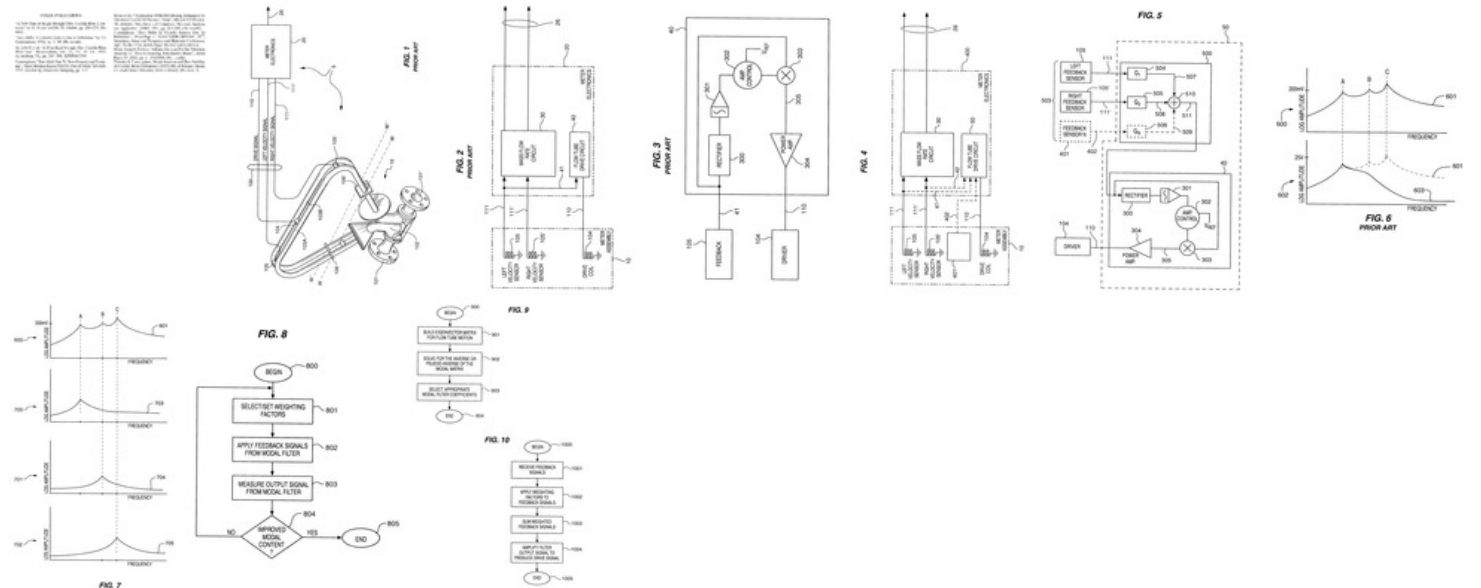
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MICRO MOTION*

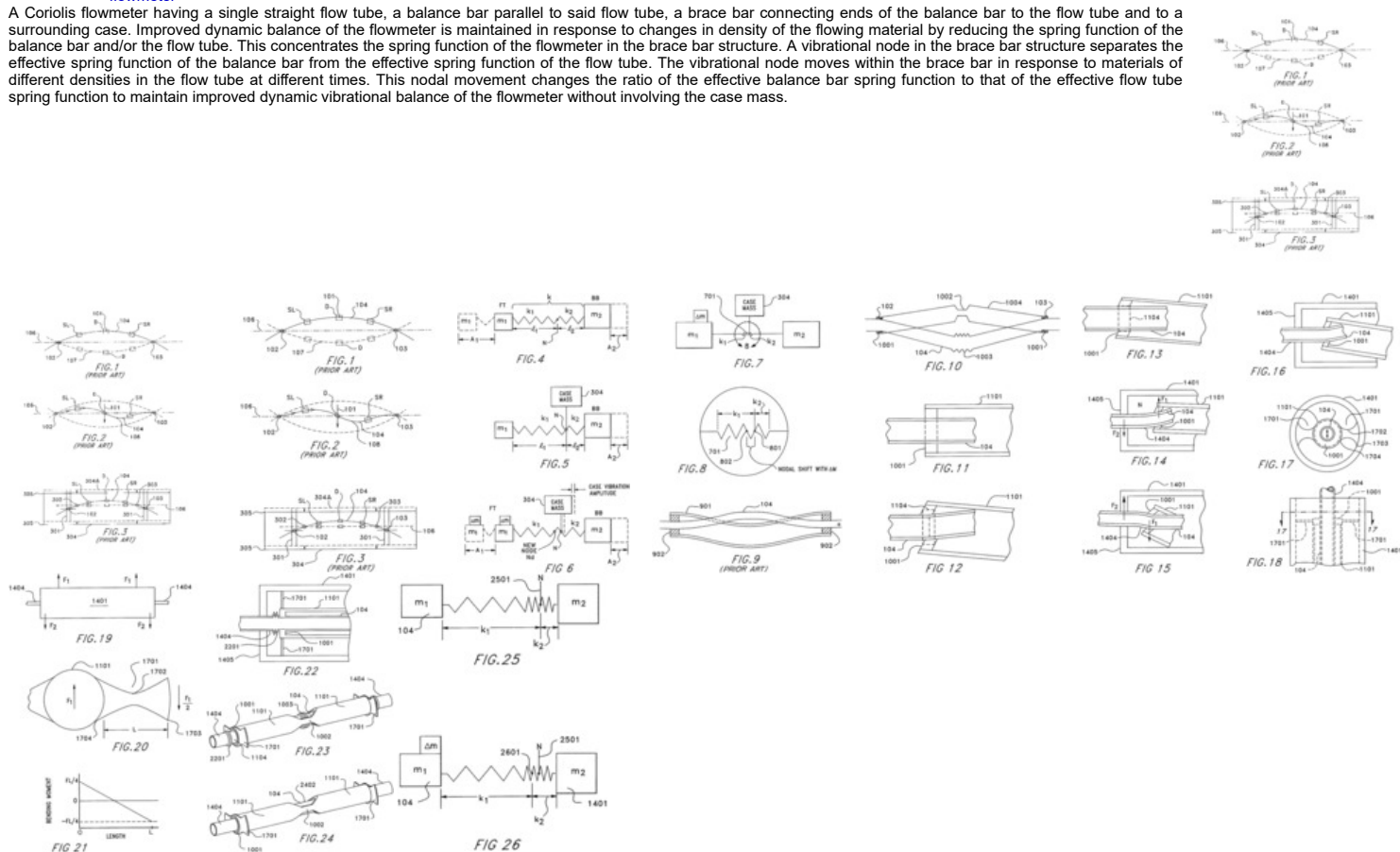
1999-01-21

1999-01-21

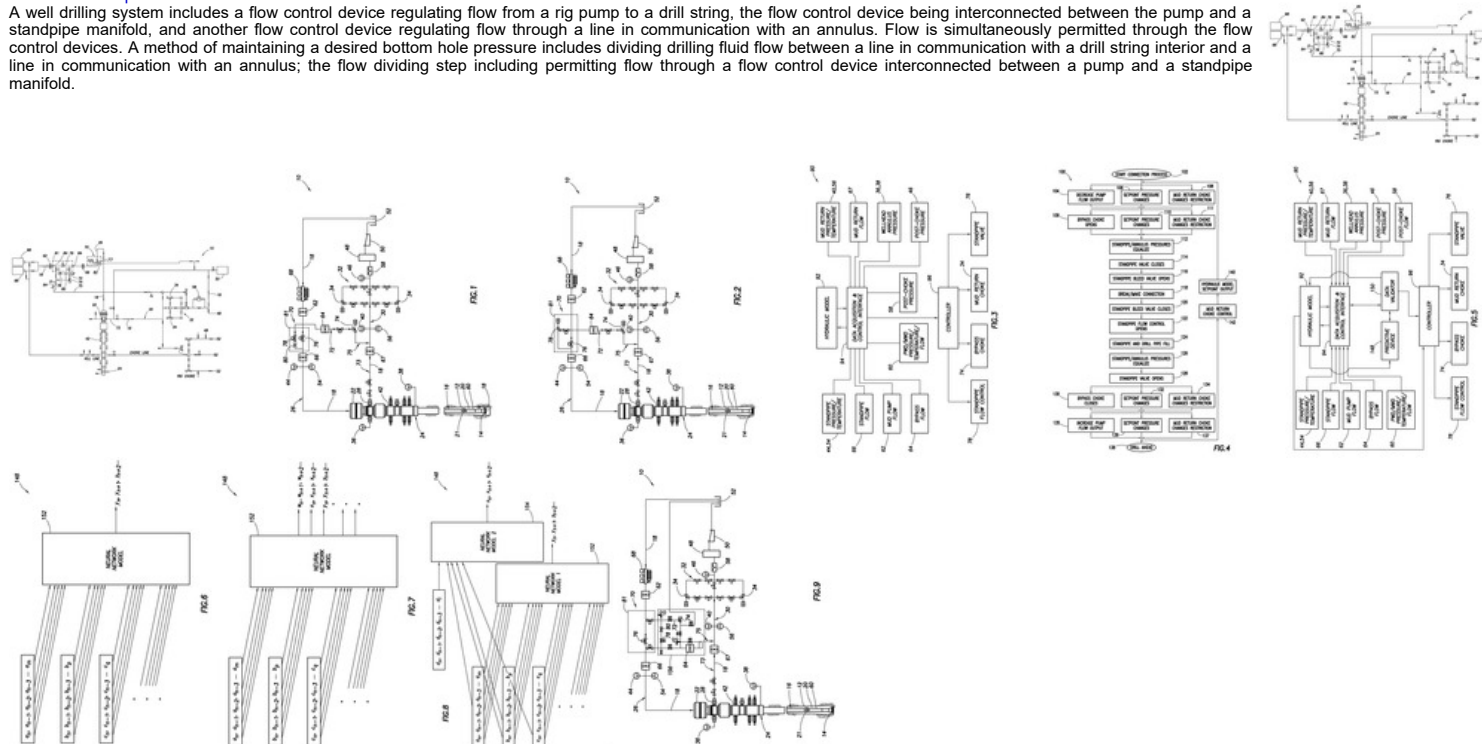
A drive system (50, 104) for a vibrating tube-based measurement instrument (5) employing a spatial filter (500) to produce a drive signal having modal content only at a desired vibration mode. Multiple feedback sensors (105, 105') located at different locations along a vibrating tube (103A, 103B) produce multiple feedback signals. Each feedback signal has applied to it a weighting or gain factor. All of the weighted feedback signals are then summed to produce a drive signal, or a signal proportional to a drive signal, having improved modal content as compared to any of the feedback signals by themselves. The weighting factors are selected by any of several means. One method is to build the eigenvector matrix for the vibrating flow tube by extracting the eigenvectors from a finite element model of the vibrating structure. The inverse or pseudo-inverse of the eigenvector matrix is calculated to obtain the modal filter vector. The appropriate set of weighting coefficients are selected from the modal filter vector.



A Coriolis flowmeter having a single straight flow tube, a balance bar parallel to said flow tube, a brace bar connecting ends of the balance bar to the flow tube and to a surrounding case. Improved dynamic balance of the flowmeter is maintained in response to changes in density of the flowing material by reducing the spring function of the balance bar and/or the flow tube. This concentrates the spring function of the flowmeter in the brace bar structure. A vibrational node in the brace bar structure separates the effective spring function of the balance bar from the effective spring function of the flow tube. The vibrational node moves within the brace bar in response to materials of different densities in the flow tube at different times. This nodal movement changes the ratio of the effective balance bar spring function to that of the effective flow tube spring function to maintain improved dynamic vibrational balance of the flowmeter without involving the case mass.



A well drilling system includes a flow control device regulating flow from a rig pump to a drill string, the flow control device being interconnected between the pump and a standpipe manifold, and another flow control device regulating flow through a line in communication with an annulus. Flow is simultaneously permitted through the flow control devices. A method of maintaining a desired bottom hole pressure includes dividing drilling fluid flow between a line in communication with a drill string interior and a line in communication with an annulus; the flow dividing step including permitting flow through a flow control device interconnected between a pump and a standpipe manifold.





12/12