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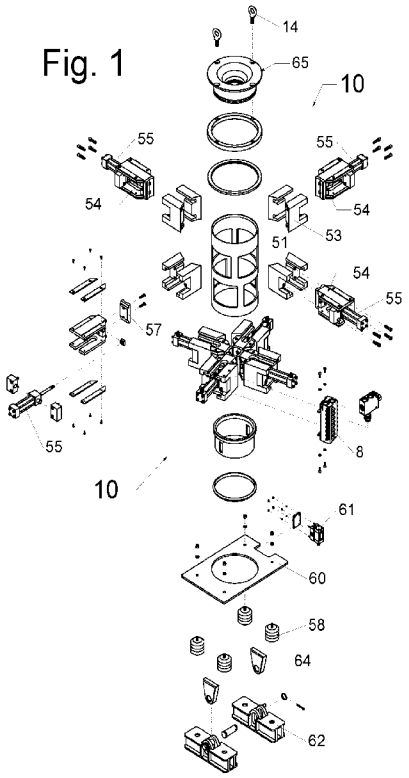
(54) Title: MOUSE HOLE PIPE HANDLING APPARATUS AND METHOD OF USE

Fig. 1



(57) Abstract: The system provides a power-actuated hydraulic or pneumatic pipe handling and gripping device with the capabilities of gripping multiple sizes of pipe without changing any components while said drill pipe is positioned within a standard drilling rig Mouse Hole in order to facilitate the make-up and break-out of said drill pipe within the Mouse Hole with standard and hydraulically operated drill pipe wrenching tools. The system increases efficiency of the drilling operation by enhancing the ability of the drill rig operator to make-up and break out drill string joints while in the Mouse Hole while promoting the safe operation of the drill rig crews by removing crews from the Mouse Hole work area during these operations. The drill rig crews also benefit by reducing the amount of times the drill rig crew has to handle heavy drill pipe slips during the drilling operation.

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MOUSE HOLE PIPE HANDLING APPARATUS AND METHOD OF USE

Field of Invention

The present invention relates to a new drill pipe handling apparatus; more specifically, to a powered clamping device capable of holding drill pipe and oil country tubular goods in a Mouse Hole while the drilling personnel make up a length of drill string.

Background Of The Invention

Drilling and exploration rigs are equipped with various methods of handling multiple sizes and weights of drill pipe and oil country tubular goods (OCTG). The drill pipe is brought to and placed on the drill floor by the rig personnel by various mechanical means of either being pulled or lifted to the drill floor on said rigs through the V-door on the drilling rig. The drill pipe is generally then placed within a pipe type structure beneath the drill floor with the opening at the drill floor level in order to facilitate the process of adding or removing drill pipe single joints to form or break down multiple lengths of drill pipe to facilitate the drilling process. This structure is commonly known as "The Mouse Hole" on exploration and production drilling rigs. This invention is designed to reduce cost while increasing efficiencies including time while handling the drill pipe in the Mouse Hole area while helping to make the operation safer and less strenuous for the drilling personnel.

The present apparatus relates to a system to assist in efficiently and safely handling multiple sizes of drill pipe within the Mouse Hole to enable the crews to actuate the invention to hold the drill pipe at various heights to allow the crews to make up said drill pipe with the automatic mechanical pipe spinning or torqueing tools currently in use within industry. The apparatus is designed to be constructed in such a manner as to hold said drill pipe within the Mouse Hole with sufficient clamping force to hold up to three joined multiple lengths of drill

pipe without slippage and without damaging the drill pipe. The apparatus's inherent design allows for various clamping mechanisms to be used to hold the drill pipe including the use of hydraulic or pneumatic cylinders. Alternatively, industrial reinforced hydraulic or air bag structures--which are constructed in a donut type shape which allows the drill pipe to be centered within the structure and the Mouse Hole. The clamping force is transmitted from the clamping mechanism to the drill pipe by the specially formulated, designed and manufactured polymer pads (clamping pads). The clamping pads are constructed in such a manner as to allow multiple sizes of drill pipe to be held without changing the clamping pad sizes. The design of this apparatus incorporates a method to easily, efficiently and quickly replace the clamping pads as needed.

In the case of severe service requirements or heavier OCTG, the polymer clamping pads can be replaced with standard metallic dies currently in use in the industry. The design of the apparatus also incorporates a hydraulic or pneumatic control device, which thereby enables to apparatus to utilize and be powered by current hydraulic or pneumatic systems on the drill rigs on which the invention is installed. Said control device also includes necessary regulators and pressure gauges in order to reduce the pressure within the system in order to increase the safety of the inventions operation and to prevent damage to the drill pipe during the clamping phase of the invention. An additional design feature of this invention is that when the drill pipe is clamped with the structure, it is automatically centered in the Mouse Hole thereby facilitating the correct alignment of the drill pipe during the joining or assembly of the stand of drill pipe as well as the break out or disassembly of the multiple joints of the drill pipe. The structure of the apparatus incorporates resilient shock bushings made from rubber or other similar types of material which are designed to be used within the industry without adverse deterioration due the effects of

various chemicals and additives used in drilling fluids or mud within the industry. The apparatus handles various sizes of standard drill pipe and OCTG.

Existing Problems and Solutions

Currently drilling rigs utilize various means to make up or assemble the drill pipe or break out or disassemble the drill pipe. These include the standard method of bringing the drill pipe to the rig floor with chain hoist tied around the leading end of the drill pipe while on a structure generally called a catwalk. The drill pipe is then pulled up into the drill floor area from a structure connected to the catwalk. This structure is generally called a V-door and the drill pipe is then placed into the Mouse Hole for make up within the drill string. Newer methods include the use of automated or semi-automated pipe rack connecting the cat walk and V-door permitting machines available from various manufacturers to quickly and easily bring the drill pipe onto the rig floor and deposit them in the Mouse Hole for connection to the prior drill pipe awaiting connection to form the longer stands of drill pipe. Once in the Mouse Hole, the pipe is joined one by one to the drill string by the travelling blocks being lowered to pick up the single drill pipe joints for lifting into the well center area for make up with standard pipe tongs or various mechanical machines including wrenching tools, top drives or similar semi-automated or automated machines. In addition to or in conjunction with semi-automated and automated pipe wrenching tools, many drilling contracting companies utilized a semi-automated Mouse Hole wrenching tool to save time in making up or breaking out the multiple joints of drill pipe. These tools are in wide usage within the drilling industry and greatly speed up the drilling process minimizing the cost of having the rig on site. These tools are no longer needed. By using the standard drilling rig wrenching tools and the clamping Mouse Hole apparatus of the present

application, multiple connections of drill string pipe can be made in the Mouse Hole without any of the attendant problems of the motorized rotating Mouse Hole apparatus found in the market.

SUMMARY

With the advent of so many pipe-wrenching tools located on the rig floor, the need for Mouse Hole wrenching tools has been lessened. The Mouse Hole wrenching tools are comparatively more expensive, complicated and heavy as compared with this apparatus overall design. Moreover, current Mouse Hole wrenching tools are subject to excessive wear and tear and require mechanical repair thereby making them less useful on an active drilling project. This present apparatus also eliminates the heavy lifting the pipe slips from around the Mouse Hole area by the drilling crews, which will in turn help to reduce back and other sprains and personal injuries.

A Mouse Hole pipe handling apparatus can be comprised of a device located beneath a drill rig drill floor with a plurality of power-actuated cylinders connected to a plurality of clamping pads; wherein each of the clamping pads is located around the periphery of the outer surface of a tubular member inserted in the Mouse Hole to centralize and hold the tubular upon actuation of the power to each cylinder. The cylinders of the Mouse Hole pipe handling apparatus can be pneumatically or hydraulically actuated. Each of the cylinders of this Mouse Hole pipe handling apparatus can be attached to a polymeric clamping pad.

The Mouse Hole pipe handling apparatus can also be fabricated so that each of the plurality of cylinders is attached to a metallic infused polymeric or a metallic clamping pad. The structure can provide a shock absorbing means to minimize excessive forces when setting a string of pipe on the previously made up drill pipe string within Mouse Hole. The Mouse Hole pipe-handling apparatus can also be constructed with a top guide assembly which incorporates a

polymeric pipe guide and a pipe-cleaning wiper or centralizer connected together and incorporated into the top opening of the Mouse Hole apparatus to protect the pipe threads and to assist in centralizing the various size pipes within the Mouse Hole pipe-handling apparatus and in cleaning the drill pipe as each section of drill pipe is inserted into the Mouse Hole. The Mouse Hole pipe handling apparatus further comprises and includes either a manually operated control system or an automated control system console (or a combination thereof) used to actuate the Mouse Hole tool and to show clamping force range in pounds per square inch per clamping pad end.

Finally, the Mouse Hole pipe handling apparatus can also provide hydraulic controls to energize a positive closure by means of the hydraulic power-actuated cylinders in compression of the drill string which pressure is held by means of the control valves until such time the manual hydraulic open controls or moved to the open position whereupon the hydraulic pressure is applied to the cylinders to power the cylinders open. This provides a positive interlock to prevent dropping of the drill pipe or OCTG due to loss of power to the cylinder system to prevent dropping of the suspended drill pipe string within the Mouse Hole should the rig lose its power. An additional feature of the device is the provision of a release mechanism built into the base of the device which, if the cylinders have not been released, any upward movement of the drill pipe or OCTG will actuate a safety release of the clamping pressure thus helping to prevent accidental lifting of the device and related apparatus and keeping them from being pulled from the drill floor.

A method of using a Mouse Hole apparatus comprises the steps of deploying the Mouse Hole apparatus on top of a Mouse Hole beneath a rig floor; introducing single joints into the Mouse Hole to allow single and multiple joints to be placed within the Mouse Hole tool; and

actuating the power-actuated cylinders to cause said cylinders to grip the pipe at varied points to safely and efficiently facilitate the make-up of a multi-drill pipe stand of drill string.

A method of using a Mouse Hole apparatus can further comprise the steps of introducing multiple joints into the Mouse Hole to allow multiple joints to be placed within the Mouse Hole tool; actuating the power-actuated cylinders to cause said cylinders to grip the multiple joints of pipe at various points to safely and efficiently facilitate a break-out of a multi-drill pipe stand of drill string.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded view of the Mouse Hole apparatus showing the deployment of the power cylinders around the periphery of the body.

Fig. 2 is an isometric side view of the Mouse Hole apparatus showing the spaced relationship of the cylinders showing the cylinders fully engaged to hold a drill string with the clamping pads.

Fig. 3 is a top view of the Mouse Hole apparatus.

Fig. 4 is an cross-sectional view of the Mouse Hole apparatus pipe guide assembly.

Fig. 4a is a top view of the Mouse Hole apparatus pipe guide assembly.

Fig. 4b is a top perspective view of the Mouse Hole apparatus pipe guide assembly.

Fig. 4c is a bottom perspective view of the Mouse Hole apparatus pipe guide assembly.

Fig. 4d is an exploded view of the Mouse Hole apparatus pipe guide assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

As shown in Fig. 1, a tubular body **51**, is assembled to hold one or more slider adapters **53**, permitting a plurality of hydraulic cylinders **55** to be placed around the periphery of the tubular body **51**. On the distal end of each throw of the plurality of hydraulic cylinders is a clamping pad **57** providing a polymeric material designed to grip the suspended drill pipe or

OCTG suspended in the Mouse Hole. For larger sizes and heavier pipe such as drill collars or casing strings, the length of these polymeric clamping pads **57** can be extended to provide a longer gripping surface and therefore a higher frictional coefficient; or, the pads **57** could be replaced with metallic hard-faced pads to suspend the drill pipe or OCTG within the Mouse Hole. The inner diameter of the mousehole cap and body **51** is 10.02 inches, thereby accommodating tubular goods up to 9-5/8 inches. This entire assembly is then mounted over a Mouse Hole well known to the drilling industry as a tubular piece suspended from a drilling rig floor into which drill pipe can be held and assembled prior to connection with the working drill string. Tubular body **51** could also provide an attached pipe wiper (not shown) to act both as a centralizing means and to clean the outer surface of the pipe being lowered into the Mouse Hole. The description of prior art useful for background information can be found in United States Patent No. 5,351,767, which is incorporated herein by reference as if fully copied herein.

The slider adapters **53**, connected to a plurality of hydraulic cylinders **55** to be placed around the periphery of the tubular body **51** are provided hydraulic power through manifold assembly **8** which distributes the hydraulics from pumps or tanks located on a rig floor (not shown) all in a manner well known in this art. A safety release valve and mounting apparatus **61** are connected to the hydraulic lines engaging the slider adapters **53** and hydraulic cylinders **55** to immediately dump hydraulic pressure on the cylinders if needed in an emergency.

Fig. 2 is an assembled isometric view of this same Mouse Hole apparatus **10** installed on top of the Mouse Hole and supported on a standard support bracket **62** which can provide shock absorbing springs **58** supporting the base plate **60**. Fig. 3 is a top view of the Mouse Hole apparatus **10** assembled showing the spaced relationship of the power actuated cylinders **55** which provide motive forces to move the clamping pads **53** into contact with the drill pipe (not

shown) inserted within the Mouse Hole. As noted these power actuated cylinders **55** are angled one degree (1°) to insure the lower assembly will not be flush against a foundation created for a rotating Mouse Hole tool.

In operation, a Mouse Hole consisting of a large tubular member is inserted under a drilling rig floor. The large tubular body **51** as shown in Fig. 1 would typically provide shock absorbing springs **58** mounted on base supports **62** and a base plate **60** capable of pivoting on pivot lugs **64** connected to the base support **62** to prevent the drill string or OCTG inserted therein from crushing engagement with the bottom of the Mouse Hole. This assembly **10** would be hung from a Mouse Hole foundation typically formed from steel beams (not shown) attached to the bottom of the rig structure. Within this Mouse Hole foundation, the present apparatus **10** would be inserted on mounting brackets **62** providing shock absorbers **58** in a well known manner to provide additional cushioning upon insertion of drill string into the Mouse Hole apparatus **10**. This Mouse Hole foundation can be fabricated to accommodate an angle of insertion of the drill pipe into the Mouse Hole apparatus by bushings or shims (not shown) to tilt the foundation or by movement of the drill pipe suspended in the Mouse Hole itself. The angle of insertion is determined by the design of the rig and the location of the V-door and these design choices can be readily adjusted to these differing designs. In most rig floor designs, this angle is 5° or less. The alignment of the mounting brackets **62** is made to accommodate the entry of the tubular at an angle to the rig floor.

Since the motive force of spinning up the drill pipe is contained on the drill rig floor, the weight of the present Mouse Hole apparatus **10** is substantially less than the hydraulically rotating Mouse Hole previously described in the industry. Thus, installation of the Mouse Hole apparatus **10** of the present application can be accomplished with a standard winch connected to

lifting rings **14** as shown in Figs. 1-2, which winch facilities are found on most rig floors. It is estimated that the present apparatus **10** will be half the weight of the conventional rotating Mouse Hole for which it is designed to replace and much less expensive to fabricate and install.

Another feature of the present application is the use of polymeric clamping pads **57** which should provide significantly less damage to expensive drill string tubulars which can be damaged by excessive use of slips used in the Mouse Hole bowl of the rotating Mouse Hole apparatus.

Fig. 4, is a cross-sectional view of the centralizing wiper system **65** of the present Mouse Hole pipe handling device. Fig. 4a is a top view of the centralizing wiper system **65** shown in Fig. 4. Fig. 4b is a top perspective view of the centralizing wiper system **65** shown in Figs. 4 and 4a. Fig. 4c is a bottom perspective view of the centralizing wiper system shown **65** in Figs. 4, 4a, and 4b. Fig. 4d is an exploded view showing the components of the centralizing wiper system **65**. Top centralizing element **66** is fabricated from a polymeric material, most preferably polytetrafluoroethylene (PTFE). Other machinable polymers, such as nylons, acetals, polyethyleneterephthalate may be substituted for the PTFE without departing from the spirit of this disclosure. An elastomeric wiper **67** is inserted immediately below the polymeric centralizing element **66** adjacent, which is then retained on the bottom of the centralizing top element **66** by a retaining plate 68. Screws, such as a plurality of cap-headed screws, secure the three elements together allowing the substitution of different sized wipers depending on the size of drill pipe or OCTG being used in the drilling operation.

CLAIMS

1. A Mouse Hole pipe handling apparatus comprising:

a device located beneath a drill rig drill floor providing a plurality of power-actuated cylinders connected to a plurality of clamping pads;

wherein each of the plurality of clamping pads is located around a periphery of the outer surface of a tubular member inserted in the Mouse Hole to centralize and hold the tubular upon actuation of the power to each power-actuated cylinder.

2. The Mouse Hole pipe handling apparatus of claim 1 wherein each of the plurality of cylinders is hydraulically actuated.

3. The Mouse Hole pipe handling apparatus of claim 1 wherein each of the plurality of cylinders is pneumatically actuated.

4. The Mouse Hole pipe handling apparatus of claim 1 wherein each of the plurality of cylinders is attached to a polymeric clamping pad.

5. The Mouse Hole pipe handling apparatus of claim 1 wherein each of the plurality of cylinders is attached to a metallic clamping pad.

6. The Mouse Hole pipe handling apparatus of claim 1 wherein the device is contained within a structure providing a shock absorbing means to minimize excessive forces when setting a string of pipe on the previously made up drill pipe string within Mouse Hole.

7. The Mouse Hole pipe handling apparatus of claim 1 further comprising a centralizing wiper assembly connected to the top of the pipe handling apparatus.

8. The centralizing wiper assembly of claim 7 wherein the centralizing element is fabricated from a machineable polymeric material.

9. The centralizing wiper assembly of claim 8 wherein the machineable polymeric material centralizing element is polytetrafluoroethylene.

10. The Mouse Hole pipe handling apparatus of claim 1 wherein the apparatus is adjustably tilted to accept entry of a tubular member at an angle.

11. The Mouse Hole pipe handling apparatus of claim 1 further comprising an automated control system console used to actuate the Mouse Hole tool and to show clamping force range in pounds per square inch per clamping pad end.

12. The Mouse Hole pipe handling apparatus of claim 1 further comprising an solenoidal interlock holding the power-actuated cylinders in compression with the drill string upon loss of power to the cylinder system.

13. A method of using a Mouse Hole apparatus comprising the steps of:

deploying the Mouse Hole apparatus on top of a Mouse Hole beneath a rig floor;

introducing single joints into the Mouse Hole to allow single and multiple joints to be placed within the Mouse Hole tool; and,

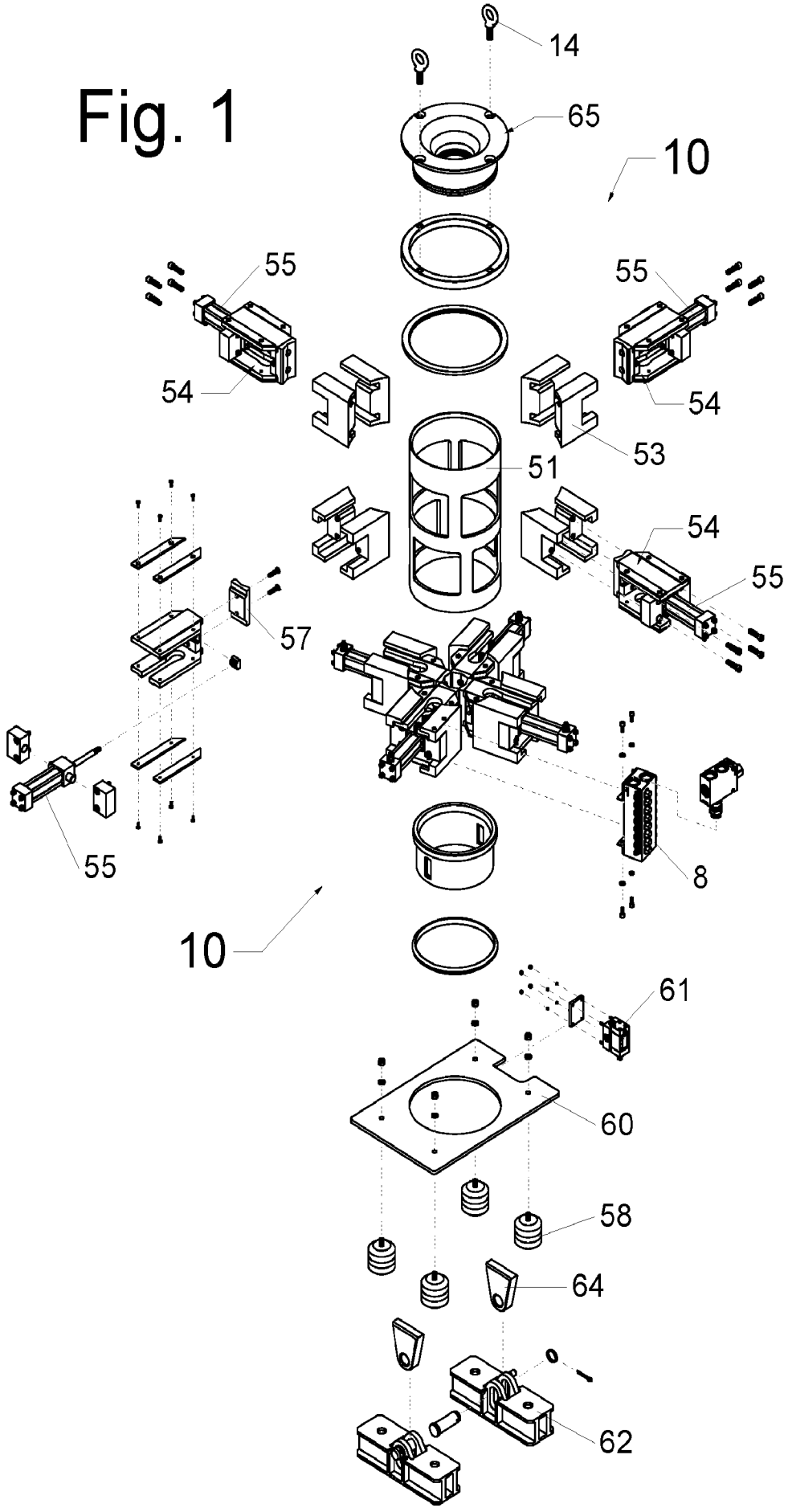
actuating the power-actuated cylinders to cause said cylinders to grip the pipe at varied points to safely and efficiently facilitate the make-up of a multi-drill pipe stand of drill string.

14. A method of using a Mouse Hole apparatus of claim 9 further comprising the steps of:

introducing multiple joints into the Mouse Hole to allow multiple joints to be placed within the Mouse Hole tool; and,

actuating the power-actuated cylinders to cause said cylinders to grip the multiple joints of pipe at varied points to safely and efficiently facilitate a break-out of a multi-drill pipe stand of drill string.

Fig. 1



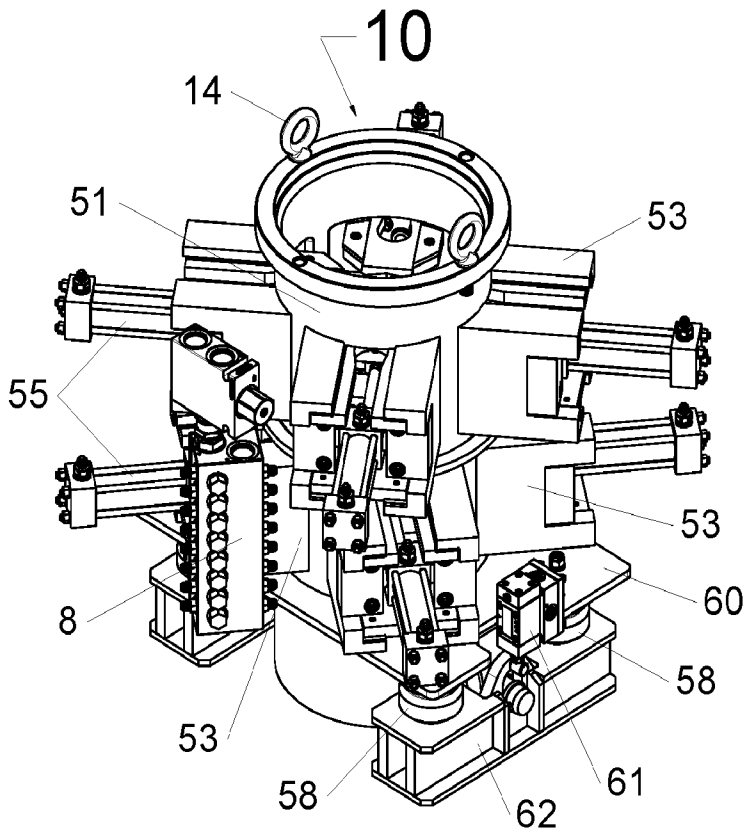


Fig. 2

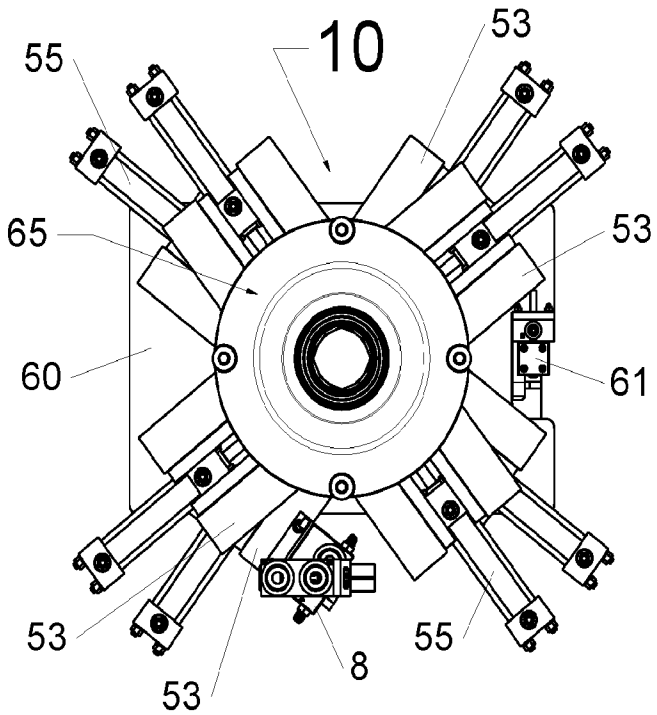
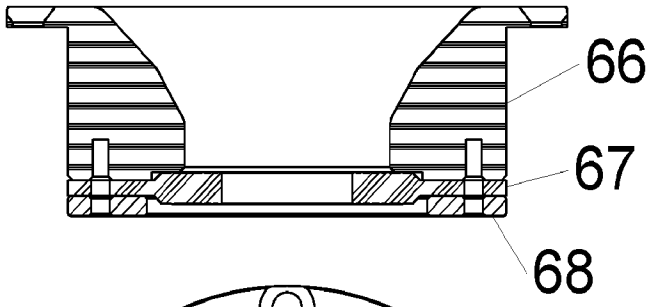


Fig. 3

Fig. 4



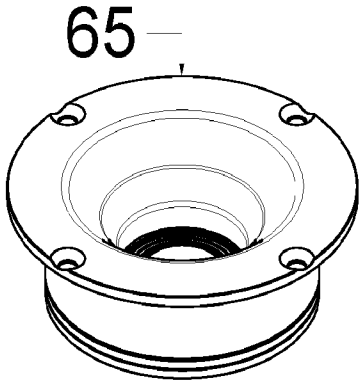


Fig. 4b

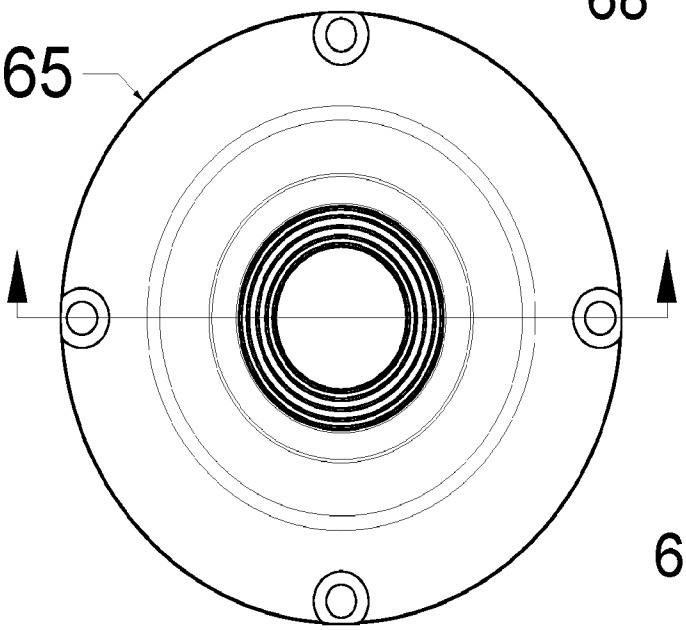
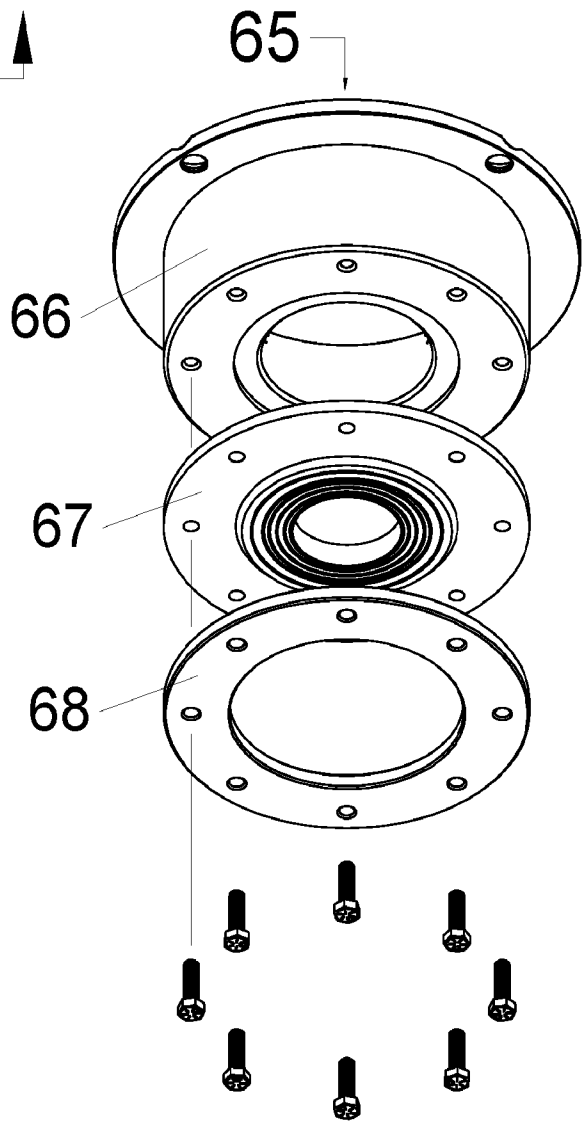


Fig. 4a



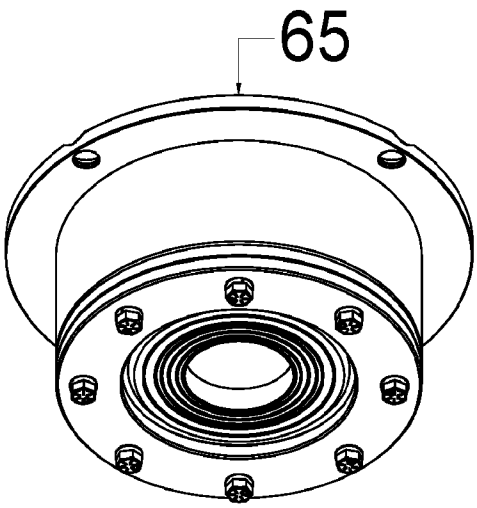


Fig. 4c

Fig. 4d

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/21265

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - E21B 19/06 (2016.01)
CPC - E21B 19/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC (8): E21B 19/06 (2016.01)
CPC: E21B 19/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC (8): E21B 19/06 (2016.01) USPC: 175/24,40,57,84,220; CPC: E21B 7/00,19/06,19/16,19/165,33/08,37/02,44/00 (keyword limited; terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase; PubWEST (PGPB,USPT,USOC,EPAB,JPAB); Google (Patents,Scholar,Web) Search terms used: mouse hole pipe handle drill clamp pad rig radial oil well actuate hydraulic pneumatic cylinder hold rod adjust tilt angle automatic control console force square inch tubular grip polymer wiper teflon polytetrafluoroethylene string etc.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 8,235,105 B2 (ANTHONY) 07 August 2012 (07.08.2012), entire document, especially Fig 2, 5, 10; col 1, ln 15-20; col 3, ln 10-14, ln 49-52; col 4, ln 1-13; col 6, ln 21-23; col 7, ln 30-34, ln 30-43; col 9, ln 11-15; col 10, ln 6-9; col 13, ln 4-9, ln 20-37	13 ---------- 1-12, 14
Y	US 2014/0299376 A1 (BERTELSEN) 09 October 2014 (09.10.2014), entire document, especially Fig 8, 13, 14; para [0005], [0017], [0049]-[0050], [0052], [0064], [0070]-[0071], [0083], [0092]	1-12, 14
Y	US 3,215,010 A (MONTGOMERY et al.) 02 November 1965 (02.11.1965), Fig 2, 3; col 1, ln 17-20; col 2, ln 60-62; col 3, ln 25-29	4
Y	US 3,074,753 A (GARDNER) 22 January 1963 (22.01.1963), Fig 1; col 1, ln 10-11; col 2, ln 43-44	5
Y	US 3,774,697 A (BROWN) 27 November 1973 (27.11.1973), Fig 2, 4A; col 4, ln 6-13; col 6, ln 51-53	6
Y	US 3,368,252 A (MEEK, Sr.) 13 February 1968 (13.02.1968), Fig 2; col 1, ln 30-34; col 5, ln 69-72; col 6, ln 3-10	7-9, 14
Y	US 4,296,321 A (BLINCOW et al.) 20 October 1981 (20.10.1981), Fig 3, 5; col 3, ln 13-18, ln 36-42	11
Y	US 3,870,165 A (BESIJN) 11 March 1975 (11.03.1975), Fig 9a-d; col 2, ln 40-42; col 8, ln 63-66; col 9, ln 12-18	12

☒ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 April 2016	12 MAY 2016
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/21265

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7,900,662 B2 (WALL et al.) 08 March 2011 (08.03.2011), col 5, ln 59-62	4, 5
A	US 4,706,747 A (SCHNEIDER) 17 November 1987 (17.11.1987), col 1, ln 61-63; col 2, ln 59; col 3, ln 20-26	7
A	US 4,405,022 A (WILL) 20 September 1983 (20.09.1983), col 1, ln 5-12	10
A	US 2013/0025847 A1 (BAIER et al.) 31 January 2013 (31.01.2013), entire document	1-14