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OIL AND GAS WELL SAND TESTER

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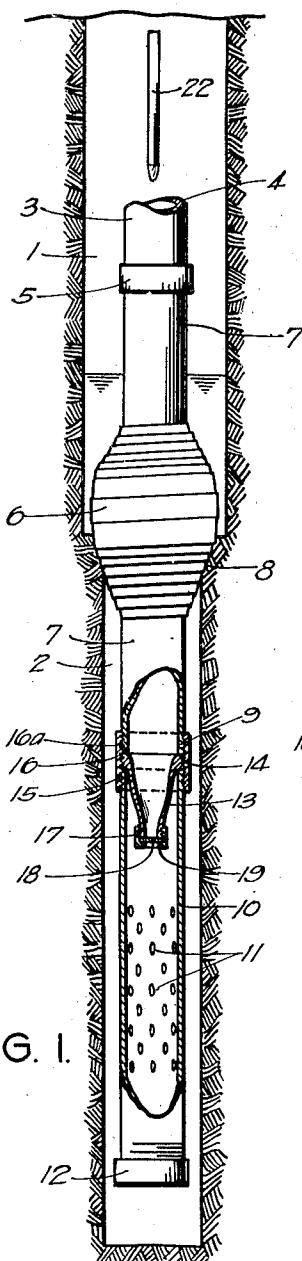


FIG. 1.

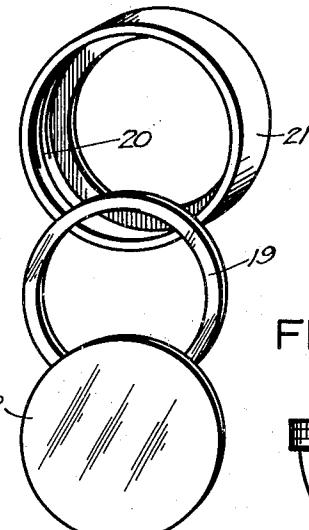


FIG. 2.

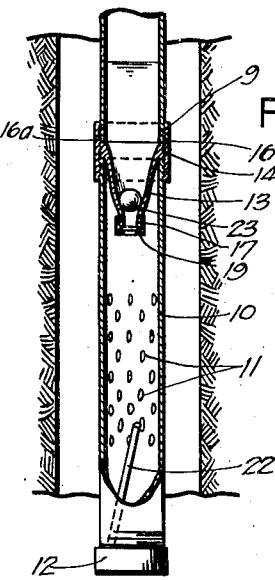


FIG. 3.

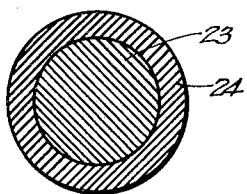


FIG. 4.

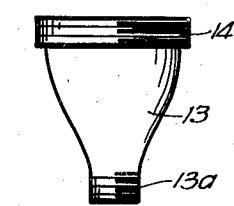


FIG. 5.

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# UNITED STATES PATENT OFFICE.

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## OIL AND GAS WELL SAND TESTER.

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My invention relates to improvement in oil and gas well sand tester.

The objects of my invention are to provide a device of the class described which will be new, novel, simple, cheap, strong, durable, efficient and of utility; which will make it possible at any time desired to make a test of the sand in a well without the necessity of casing the hole, or well; which will under 10 such test prevent the caving in of the hole, or well, and the possible consequent loss of the hole, or well; makes practically a standard rig out of a rotary drilling outfit in so far as testing the sand is concerned; will be 15 cheap in operation; will save the necessity of spending thousands of dollars in casing in each well drilled by a rotary rig; and will accomplish efficiently the purposes for which my device is intended.

At the present time in the drilling of a well with a rotary drilling outfit it is necessary to reduce the size of the hole from that which is then being used. That is, when a cap rock or a change of formation is found 25 which indicates the approach of a producing sand it is necessary to reduce the size of the hole from that which is then being used and to thereby form what is known as a "rat-hole", and to thereafter drill by a bit of a 30 reduced size into the formation therebelow suspected of being productive of either gas or oil. When a sufficient depth has been reached therebelow and a test is desired to be made it is necessary to set a string of casing 35 from the top of the well to the seat made by the "rat-hole" by the reducing of the size of the hole. Before the sand can be tested this must be cemented into the hole and can not thereafter be removed. This necessitates 40 the loss of that string of casing. If no production is found then the hole is continued on the inside of the set casing and necessarily of a reduced size to a greater depth in said reduced sized hole. If a formation is reached 45 causing the belief of another sand having been found the above described process is of necessity repeated and a new "rat-hole" formed and another set of casing is installed and set from the top of the hole to the second reduced sized hole at said "rat-hole". 50 And if production is not found here this casing is also lost since it too has to be cemented. This process continues unless a paying sand is found until it can not go further in 55 the sized hole then being drilled and the size of the hole then is reduced to such an extent

that a new well must be begun and practically all of this casing is lost. This results in the loss of the hole or well before the desired depth has been reached which was intended to be reached from the beginning. All of the above disadvantages and losses will be obviated and saved by my invention as will be seen in the description hereinafter given and all of the sands found under the use of my invention will have been thoroughly tested.

With these and other objects in view, my invention consists in the construction and novel features, and combination of parts hereinafter more fully described, illustrated in the accompanying one-sheet drawing, and pointed out in the claims hereto appended; it being understood that various changes in the form, proportion, size, shape and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or principle of the invention, or sacrificing any of the advantages thereof.

The novel features, invention and other objects will be more fully shown in the specification, claims, and accompanying one-sheet drawing, of which,

Figure 1 is a perspective view of the device, partly in section; Fig. 2 is a perspective view showing a breakable bottom cap, a ring holding member and their cap sheath; Fig. 3 is a sectional view of a portion of the device showing the presence of a ball-valve; Fig. 4 is a sectional view of the ball-valve and its outer casing; and Fig. 5 is an elevational view of a reducing nipple.

Like characters of reference designate like parts in all the figures.

One embodiment for the accomplishing of the purposes for which my invention is intended is as follows:

The larger sized drilling hole is shown at 1 and the reduced or smaller size is shown at 2; the drill stem is shown at 3 with an upper broken-off portion at 4 and a lower broken-off portion at 5. I provide a packer 6 around the drill stem 1 constituting it in that instance a packer stem 7. The object of the packer 6 is to entirely fill what is known to those familiar with the art as the "rat-hole" 8 formed of the juncture of the larger hole 1 and the smaller hole 2 and permit said packer to be securely held in said "rat-hole", and to permit the parts therebelow to depend in the smaller hole 2. At the packer 6 on the lower end of the drill stem 3 I provide an ex-

ternally threaded portion 9. I also provide a perforated casing 10 having a plurality of perforations 11 for the admission therein from the outside of water, oil, gas and the like, from the portion of the smaller hole 2. Said perforated casing is sealed at the bottom end 12 with heavy metal. At its upper end it is externally threaded to match the threads 9 and the circumferential size of the lower end of the packer stem 7. I also provide a reducing nipple 13 provided for a short space with upper external threads 14 their external circumference being of the same circumferential size as the threaded portion 9 of said packer stem 7 and the threaded portion 15 of said perforated casing 10, said externally threaded portion 14 being adapted to fit between said lower end of said packer stem and upper end of said perforated casing; a tool joint 16 internally threaded at 16<sup>a</sup> is provided for securely holding said reduced nipple and said packer stem and said perforated casing in a union.

The lower end of said reduced nipple 13 is provided with external threads 17. Below the lower end thereof I provide a breakable bottom cap 18 for closing the lower end of said reduced nipple, and a ring gasket member 19 therebelow held in place by an internally threaded open ended cap sheath 21 for holding said breakable bottom cap 18 and said member 19 securely against the lower end of said reduced nipple 13. The lower portion of nipple 13 is threaded 18<sup>a</sup> to receive threads 20 on cap sheath 21. An ordinary plunger 22 for inserting into the drill stem for breaking said bottom cap is provided. I also provide a ball 23 preferably covered with a coat of rubber 24, or other suitable substance, for making a valve connection, as will be more fully described later.

In operation in the drilling of a well by a rotary rig with my invention for a deep well they usually start with a 14 inch hole for surface casing. The surface casing is usually set at about forty or fifty feet then they ordinarily drill down to the first cap rock or formation that would likely have a productive sand under it with a ten inch bit without casing. The hole at that size is then stopped and the hole reduced to a six inch bit forming what is known to the art as a "rat-hole". They then drill down into the formation below. If the formation is found favorable for oil or gas they then remove the drill stem 3 and unite packer stem 7 with the lower end of the drill stem by tool joint union 5. The drill stem with the packer stem therebelow is then lowered into the hole from the top until the packer 6 on packer stem 7 fits into the "rat-hole" 8 tightly like a cork in a bottle below said packer 6 and above perforated casing 10 joined at its upper end by tool joint union to the lower end of said packer stem. The reduced valve nipple 13 will be securely seated

between the lower end of the packer stem 7 and the upper end of the perforated casing 10 and the breakable plate or cap 18 securely held in place by ring 19 and cap sheath 21. When this set plunger 22 is dropped into the drill stem at the top of the well and falls against breakable plate or cap 18 breaking the same and by its weight goes on down to the lower end 12 of said perforated casing 10. This will relieve all of the water pressure which will go through the perforated casing up into the packer stem and drill stem. If the sand struck is productive of gas or of oil and gas combined it will in a few seconds come out of the top of the drill stem at the top of the well which is what is known as "going over the top". If instead of sand productive of gas or of oil and gas combined it is of oil sand only after waiting a reasonable length of time, say thirty minutes or an hour and permitting the oil to raise through the perforations in the casing 10 up into the packer stem and drill stem, ball 23 which is preferably coated by rubber 24 or other suitable material, is dropped into the top of the hole and goes down into the drill stem and through the packer stem to the reduced valve nipple. This ball may be of metal or may be filled with shot or other suitable substance so as to make the same sink in either oil or water or other liquid. Said ball then sinks into the reduced valve nipple and is seated therein forming a cork and holding all of the liquid in the packer stem and drill stem thereabove so that it can be drawn out and tested. The taking out of the oil can be done in any of the ordinary and usual ways or it can be done by withdrawing the drill stem and packer stem. Thereafter the tests for oil or salt water or other kind of liquid can be made. If no production is found the packer stem containing my invention therebelow is removed from the drill stem by loosening the tool joint above the packer stem and the ten inch bit is then refitted on the drill stem and the regular ten inch hole proceeded with without reduction as to size. This is continued until it is believed another favorable formation has been reached and the above proceeding as heretofore detailed is repeated.

It will be seen by those familiar with the art to which my invention pertains that under my invention the drill stem is used in lieu of the casing and that no casing has to be set or cemented and therefore none is lost thereby, it will also be seen that there is no necessary reduction of the size of the hole after having made one or a dozen tests under my device.

It will also be seen that if a producing well is found and the sand being tested under my invention and the well "goes over the top" all that is necessary to be done to do what is known in the art as "mudding it in" until the casing can be procured, is to raise the

drill stem a foot or so so that the packer un-  
stops the "rat-hole" thereby letting the mud  
pressure back on the sand in the bottom of the  
well and holding it there until my invention  
5 and the drill stem are removed from the hole  
and the ordinary and usual procedure in get-  
ting ready for the operation of a producing  
well is carried out.

I claim:

10 1. A device of the class described for test-  
ing the sands of oil and gas wells, comprising  
means for corking up the hole adjacent its  
lower end, a perforated casing having its  
lower end securely capped, its upper end  
15 being adapted to be securely fastened to the  
lower end of said corking means, a reduced  
nipple valve being seated between the lower  
end of said corking means and the upper end  
of said perforated casing, its smaller end ex-  
20 tending downwardly and being adapted to be  
normally closed by a breakable cap for pre-  
venting the flow of liquid therethrough, a  
gasket ring member and an open ended cap-  
sheath for holding said breakable cap in place,  
25 plunger means for breaking said breakable  
cap, a ball valve means for closing the lower  
neck portion of said nipple valve and shutting  
off the inflow of liquid thereinto.

2. A device of the class described for test-  
30 ing oil and gas sands in wells, comprising a  
drill stem, a packer stem and packer, said  
drill stem being adapted to be securely fas-  
tened at its lower end to the upper end of  
35 said packer stem, said packer being adapted  
to fit tightly on a shoulder between an upper  
large hole and an under smaller hole in the  
well and to seal said hole thereat, a perforated  
casing, its upper end being adapted to be fas-  
40 tened to the lower end of said packer stem,  
its lower end being adapted to be securely  
closed, a reduced nipple valve being adapted  
to be securely seated between said upper end  
of said perforated casing and said lower end

of said packer stem, its reduced end extending  
downwardly, and being adapted to be nor-  
mally closed by a breakable cap, for prevent-  
ing liquid from entering thereat until desired,  
5 and at certain periods to receive a ball valve  
inside its lower neck portion, a gasket ring  
member for positioning said breakable cap, 50  
an open ended cap sheath for securely holding  
said breakable cap and said ring gasket mem-  
ber normally securely against the lower end  
of said nipple valve, means for breaking said  
breakable cap, a heavy ball valve being coated 55  
externally for tightly fitting said nipple valve  
in its lower inside neck portion and for pre-  
venting the flow of liquid therefrom from in-  
side and thereinto from there surrounding.

3. The combination with a drill stem, pack-  
er stem and packer, said packer being adapted  
to fit tightly in a shoulder between the larger  
hole and a smaller hole therebelow of an oil  
and gas well, of a device for testing oil and  
gas sands without using and setting a string  
65 of casing, of the class described, comprising  
a perforated casing having an open upper  
end and a closed lower end, a reduced nipple  
valve being adapted to be seated between the  
lower end of said packer stem and the upper 70  
end of said perforated casing its reduced  
smaller end extending downwardly, a break-  
able cap for closing the lower end of said nip-  
ple valve and shutting out oil, gas and liquid  
therefrom when desired, a ring gasket member 75  
and an open ended cap sheath for positioning  
said breakable cap, a suitable plunger for  
dropping in said drill stem and for breaking  
said breakable cap when the admitting of oil,  
gas and liquid therethrough is desired, a suit- 80  
able ball valve having a resilient outer coating  
being adapted to be seated inside the neck  
of said nipple valve adjacent its lower end  
for holding in said packer stem and drill stem  
oil and other liquids.

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