

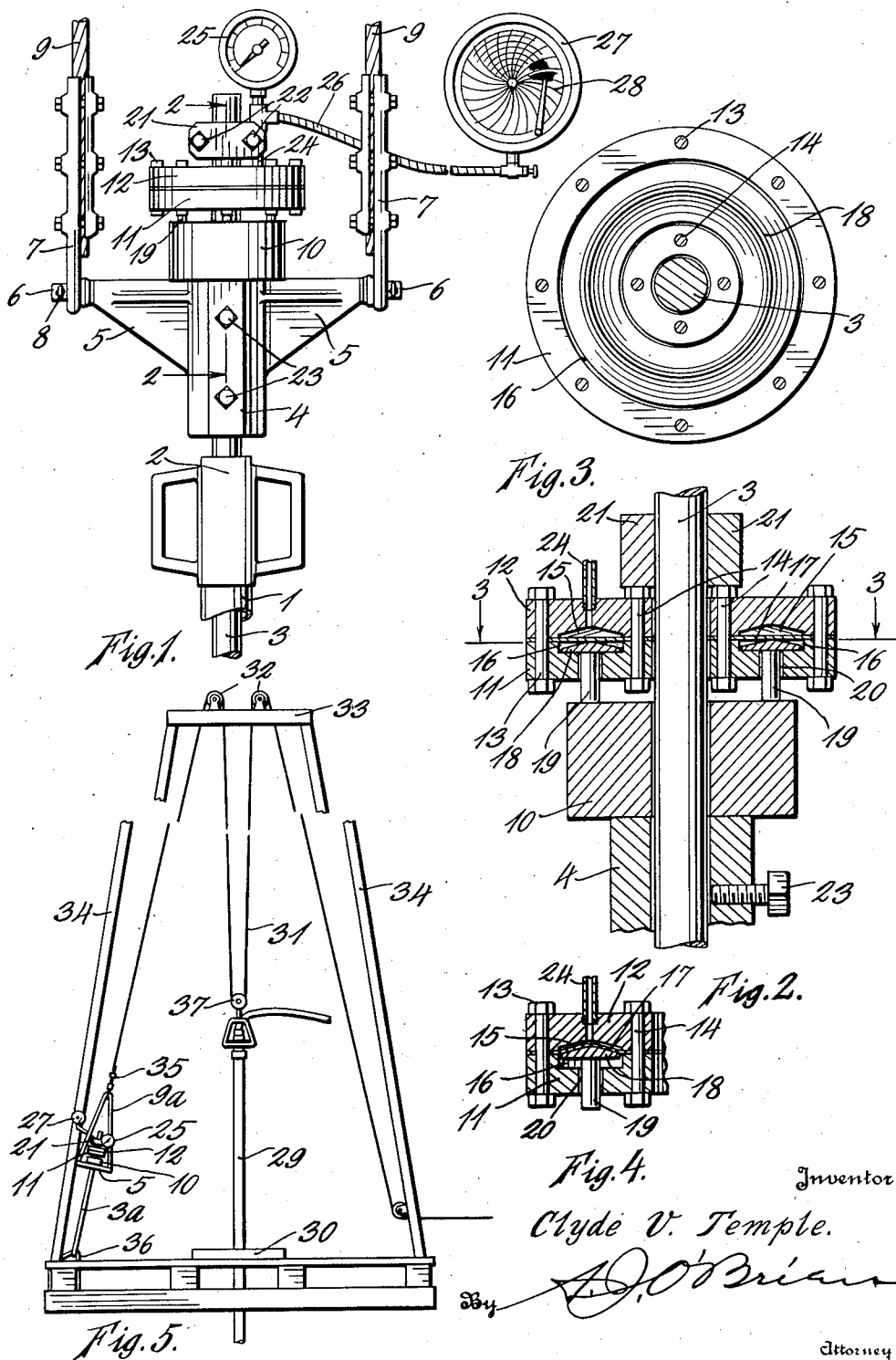
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DYNAMOMETER

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DYNAMOMETER

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This invention relates to improvements in dynamometers of the type employed in connection with the drilling and pumping of oil wells.

5 In the operation of drilling oil wells, it is very desirable for the driller to be informed as to the exact weights on his cable, so that he may know the pressure of the bit on the bottom, as this enables him to make the hole
10 at the least cost.

Too little pressure means lost time while too much pressure means an overloaded bit. A steady pressure is necessary to avoid a twist off.

15 It is the object of this invention to produce a simple, substantial, reliable device, which can be quickly attached and by means of which the operator can determine at all times the weight on his cable during the drilling
20 operation and when used in connection with pumping wells, it makes it possible to determine the amount of power required to operate the pumps and thereby to determine the efficiency of the pumping unit, the horse-
25 power required to operate it, the condition of the cups on the pump, and the weight of the liquid in the well; the determination of whether the standing and traveling valves are working properly and if the well is prop-
30 erly counterbalanced or not.

When used in connection with rotary drilling lines, it enables the operator to determine the ton miles the line has travelled and the pressure of the bit on the bottom of the hole.

35 This invention briefly described consists in a member having an annular chamber which is divided into two annular compartments by a flexible diaphragm; one of said compartments is filled with liquid, as for example,
40 oil, and is connected with a pressure indicator by means of which the pressure to which the fluid is subjected may be determined at any time. The other annular compartment contains a ring having a convex surface ad-
45 jacent to the chamber. A plurality of the plungers extend through the bottom of the annular groove that contains the ring and when pressure is applied to the plungers, forcing them inwardly, the ring will be forced
50 against the diaphragm and bend the same in

such a manner as to decrease the volume of the chamber containing the oil. The pressure to which the liquid is subjected is determined from the pressure indicator.

This device is attached in the cable line or 55 to the polish rod of a pump in such a manner that the stress will be transmitted to the diaphragm so that it may be accurately determined in the manner indicated.

The area of the diaphragm being known, 60 the total weight can be determined by multiplying the area by the pressure, which is determined from a reading of a pressure gauge. Having thus briefly described the invention, the same will now be described in detail and 65 references for this purpose will be had to the accompanying drawing in which the preferred embodiment thereto has been illustrated, and in which:

Fig. 1 is a side elevation of the improved 70 dynamometer showing the same in place at the upper end of a polish rod and shows the recording and the ordinary pressure gauges in place.

Fig. 2 is a vertical section taken on line 75 2—2 Fig. 1 and shows the annular chamber, the flexible diaphragm, the ring and the plunger.

Fig. 3 is a section taken on line 3, Fig. 2—2.

Fig. 4 is a section similar to that shown in 80 Fig. 2 and shows the position of the parts when they are subjected to pressure; and

Fig. 5 is a diagrammatic view showing the 85 manner in which the dynamometer is attached to a rotary drill equipment.

In the drawing numeral 1 represents the 85 well casing and 2 the stuffing box at the upper end thereof, while numeral 3 represents the polish rod. The upper end of the polish rod extends through a tubular member 4, 90 which is provided with two outwardly extending arms 5. These arms terminate in trunnions 6, to which the lower ends of the connectors 7 are attached. These connectors 95 are held in place by means of cotter pins 8 or some equivalent means. The connectors are secured to the lower ends of cables 9, which extend upwardly to the end of the walking beam that is usually employed for the operation of pumps for this type. Lo- 100

cated on the top of tubular member 4, so that it will be supported by an upper end of this member as well as by the upper surfaces of arms 5, is a cylindrical block 10, which is provided with a central opening for the reception of the polish rod. Supported on the upper surface of block 10 is the pressure chamber of the dynamometer. This pressure chamber is formed from two circular members 11 and 12, which are preferably of the same size and are held together by means of clamping bolts 13 and 14. Members 12 and 13 are each provided with a central opening for the reception of the polish rod and the adjacent surfaces of said members are each provided with an annular groove. The groove in block 12 has been indicated by reference numeral 15, and has a transversely concave bottom while the corresponding annular groove in block 11 has been designated by reference numeral 16 and has been shown as having a flat bottom. It is possible, however, to make the groove 16 of exactly the same shape as groove 15, but a groove having a flat bottom is somewhat more suitable. A flexible diaphragm 17, which may be made of rubberized fabric or of a steel plate suitably corrugated so as to permit it to yield, is clamped between members 11 and 12 and divides the annular chamber into two compartments. The exact material used for the diaphragm is not of any great importance, the particular requirement being that the diaphragm shall have sufficient strength and be yieldable so that it can be bent into the position shown in Fig. 4. Located within the lower compartment or the compartment formed by the groove in block 11 is a ring 18. This ring is of the proper size to fit the groove 16, and has its upper surface convex. A plurality of plungers 19 extend through the openings 20 in block 11 and rest upon the upper surface of circular block 10. The polish rod extends upward through blocks 11 and 12 and has secured to its upper end a clamp 21. This clamp is formed by two separate members that are held together by means of bolts 22. The tubular member 4 is provided with two or more set screws 23 that may be used for holding the polish rod during the assembly of the parts, but after the parts have been assembled in the manner shown and described the set screws 23 are loosened so that the entire weight of the polish rod will be supported by the upper ends of bolts 14 in the manner quite apparent from Fig. 2. Since the block 10 is supported by the cables 9 and since the weight of the polish rod is supported by the clamp 21, the entire weight of the polish rod and attached parts will, of course, be supported by the plungers 19 and this will tend to force the diaphragm upwardly into the groove in block 12. The compartment above the diaphragm is filled with fluid, as for example, oil, and is connected by means of a flexible metal

tube 24, to a pressure indicator 25. Another flexible tube 26 puts the interior of the liquid containing compartment into connection with the pressure indicator 27. It is now apparent that with the parts adjusted in the manner described, the pressure to which the liquid in the upper compartment is subjected can be determined by the reading of the pressure gauge or indicator and that by multiplying the area of the diaphragm by the pressure per square inch, the total weight of the parts supported by the dynamometer can be readily determined. The recording pressure indicator is of the usual type and is provided with a rotatable dial 28, so that a continuous record may be had of the operation for each 24 hours. These dials can be taken off and stored away for future reference. It is apparent that if this dynamometer is connected with a pump of the type employed in connection with deep oil wells that the condition of the pump can be very quickly determined from the pressure readings. If the pressure valves are leaky this will quickly show up and enable the operator to discover the fault almost as soon as it occurs.

As above pointed out, the readings obtained by means of this instrument are useful for many purposes and enable the operator to intelligently control the machinery so as to get the best results at all times.

In Fig. 5 I have shown in a more or less diagrammatical manner how this dynamometer can be attached to a rotary drill. In this view, numeral 29 designates the rotary shank of the drill which is rotated by means of gears, one of which has been indicated diagrammatically and designated by reference numeral 13.

The drill is supported by means of a cable 31, which passes over sheaves 32, supported on the crown plate 33 of the derrick. This derrick has been shown diagrammatically and is supported by four corner posts 34. One end of the cable 31 is dead ended at 35 by being fastened to the cable loop comprising a cable 9^a, which corresponds to the cable 9 in Fig. 1. The ends of this cable are connected to the arms 5, and carry the dynamometer which is assembled in the manner described above. Rod 3^a corresponds to the polish rod in Fig. 1 and has its lower end anchored to the lower end of derrick by means of a cable 36. The other end of cable 35 extends to the drum of the hoisting winch which has not been shown. It is apparent that only a certain proportion of the total weight of the drill will be supported by the dynamometer and that therefore, the reading of the dynamometer will, be directly proportionately to the weight of the tools supported by the multiple block 37, which may be several times the weight actually transmitted to the dynamometer. By a simple mathematical calculation the exact weight may be determined.

From the above description, it will be apparent that I have produced a dynamometer of a very simple and rugged construction that is well adapted to withstand the rough usage to which instruments of this type will be subjected in this kind of work. The parts are all massive and strong and the flexible diaphragm is well protected so that it will not be accidentally injured. The parts are of simple construction and can be cheaply made and readily assembled, thus making it possible to manufacture the device at a comparatively small cost. The construction is such that there is very little inaccuracy due to friction, as the polish rod is freely movable through the openings and there are no moving parts whose friction tends to destroy the accuracy of the readings.

It is, of course, apparent that the pressure gauges 25 and 27 may be placed in any convenient position as they can be connected to the pressure chamber by means of any length of flexible tubing.

Attention is called to the fact that this dynamometer does not require any extensive calibration for the reason that the forces are transmitted directly to the annular ring and to the diaphragm so that it is only necessary to multiply the area of the diaphragm with the pressure in pounds per square inch to get the total weight.

Having described the invention, what is claimed as new is:

1. A dynamometer for use in connection with well drilling machines comprising a body member having an annular chamber, a flexible diaphragm separating said chamber into two annular compartments, a liquid in one of said compartments, a pressure gauge in communication with the compartment containing the liquid, whereby the pressure of the liquid may be determined, an annular ring in the other compartment, said ring having the surface adjacent the diaphragm transversely convex and means for moving the ring toward the diaphragm so as to bend the latter whereby the volume of the chamber containing the liquid will be decreased and the liquid placed under compression.

2. A dynamometer comprising two members each having an annular groove, in one side said grooves forming an annular chamber when the two members are assembled, a flexible diaphragm located between the adjacent surfaces of the members so as to divide the annular chamber into two annular compartments, means for securing the two members together one of said compartments containing a liquid, an annular ring in the other compartment, and means for forcing the ring against the diaphragm whereby the latter will be distorted and whereby the volume of the compartment containing the liquid will be decreased.

3. A dynamometer comprising two rigid

members having an opening adapted to receive a rod, each of said members having one substantially flat surface adapted to fit against the corresponding surface of the other member, said members having their adjacent surfaces provided with a shallow annular groove concentric with the said opening, means for securing the members together so that the said openings will be in axial alignment, and so that the annular grooves will register and form an annular chamber, a flexible diaphragm located between the members, said diaphragm dividing the annular chamber into two compartments, a liquid in one of said compartments, a pressure gauge in communication with the compartment containing the liquid whereby the pressure of the liquid can be ascertained, a ring in the other compartment and means comprising a plurality of plungers for moving the ring toward the diaphragm whereby the diaphragm will be bent toward the chamber containing the liquid so as to decrease the volume thereof and put the liquid under pressure.

4. A dynamometer comprising a base having an opening, a tension member secured to said base, a second tension member extending through the opening, and means for connecting said tension members, said means comprising two similar members each having an opening through which the second tension member may pass and each having a substantially flat surface that is perpendicular to the axis of the opening means for securing the members together with the flat surfaces together the flat surface of each member having an annular groove concentric with the opening and of the same size and shape whereby when the members are secured together the two grooves form an annular chamber, a flexible diaphragm located between the members said diaphragm dividing the chamber into two compartments, a liquid filling one of the compartments, a pressure gauge in communication with the compartment containing the liquid a ring located within the other compartment, the side of the ring nearest the diaphragm being transversely convex and a plurality of plungers extending into the compartment containing the ring and engaging the latter.

In testimony whereof I affix my signature.
CLYDE V. TEMPLE.