R. B. FRYETT & H. H. BOTTEN.

HYDRAULIC INDICATOR.

APPLICATION FILED FEB. 27, 1909.

954,727.

Patented Apr. 12, 1910.

2 SHEETS—SHEET 1.

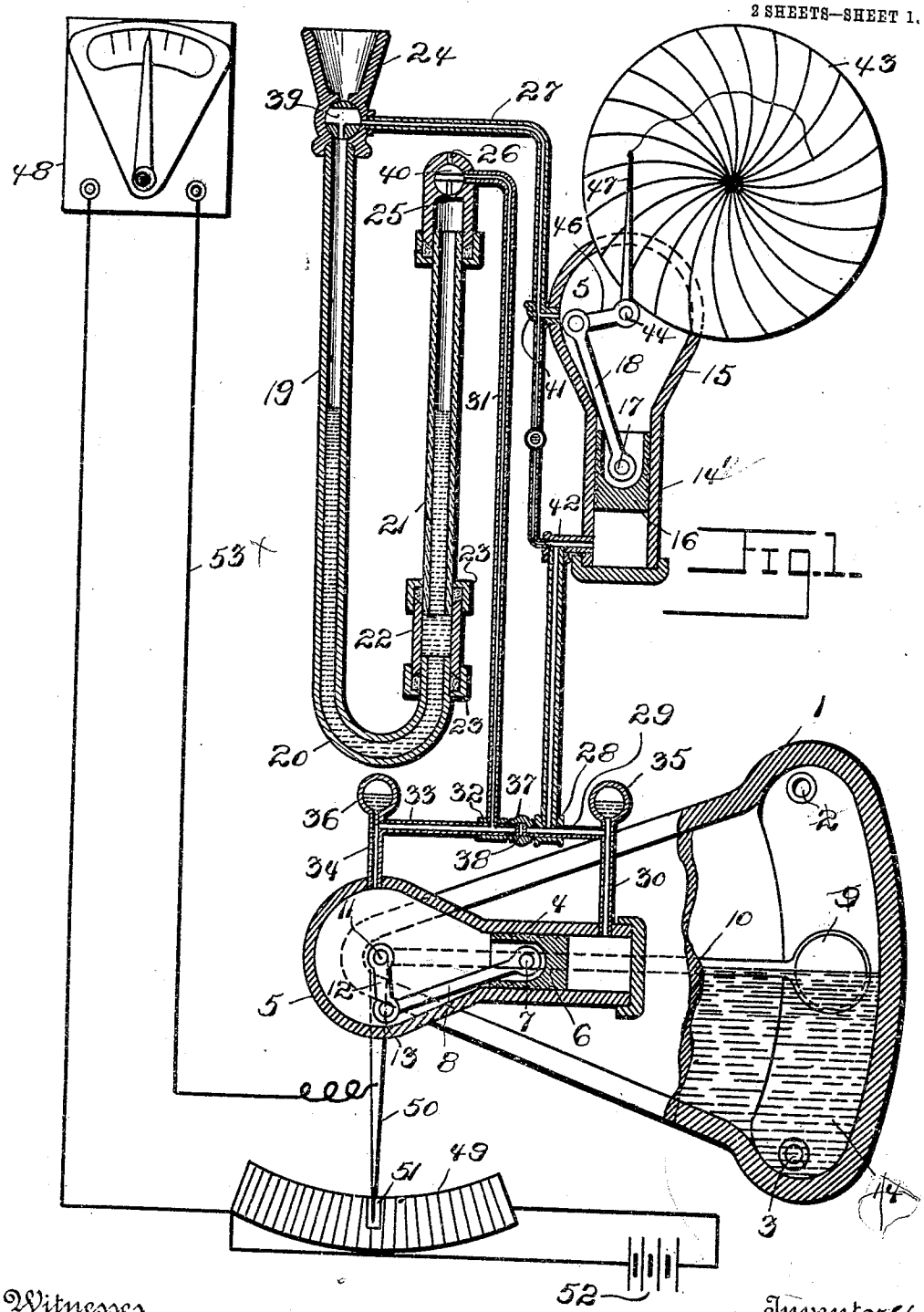

FIG. 1.

Witnesses

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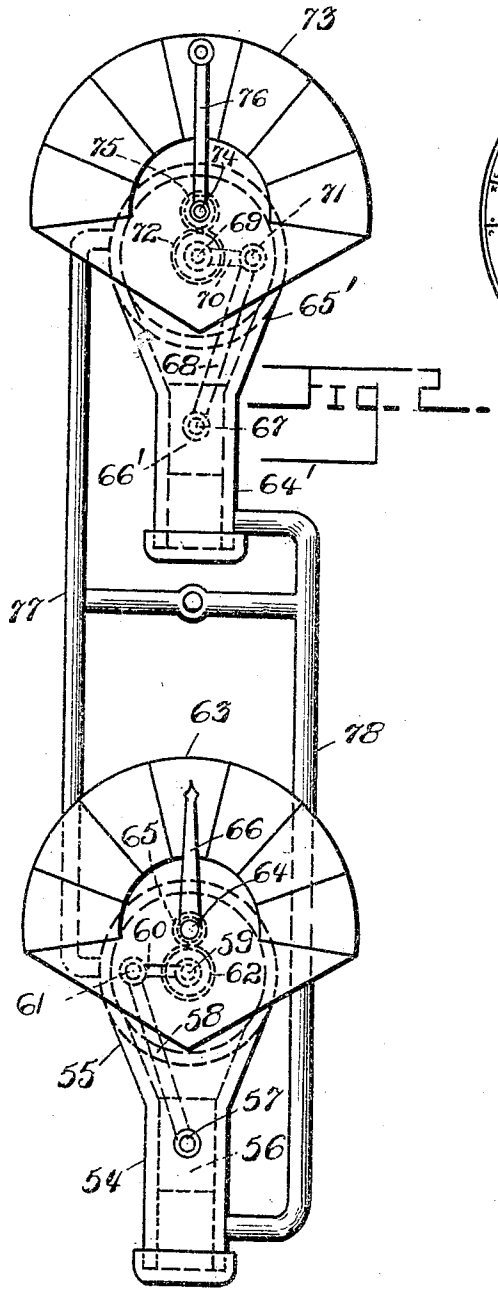

FIG. 2.

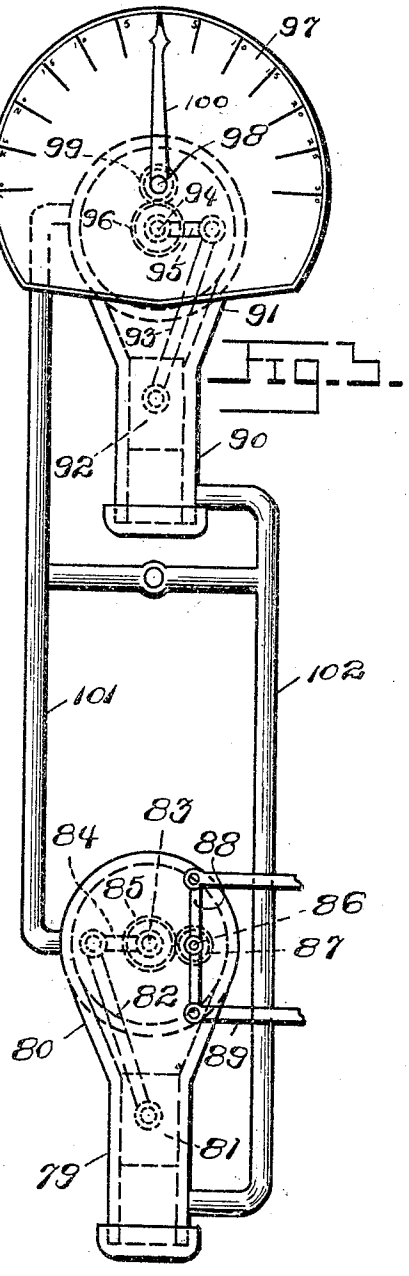

FIG. 3.

Witnesses

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HYDRAULIC INDICATOR.

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Application filed February 27, 1909. Serial No. 480,399.

To all whom it may concern:

Be it known that we, ROLLO B. FRYETT and HENRY H. BOTTEN, citizens of the United States, residing at Bremerton, in the county of Kitsap and State of Washington, have invented certain new and useful Improvements in Hydraulic Indicators, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to improvements in indicators, and particularly to the type operated by a hydraulic circuit.

One object of the invention is the provision of a device which may be employed to determine the water level in a steam boiler, the angle of a ship's rudder, or operate an engine room indicator from the bridge of a vessel.

Another object is to provide a construction which when used to determine the water level in a boiler will operate on the face of a dial and record on the latter the height of the water column for every hour of the day.

A further object is the provision of a construction wherein the friction between the working parts will be reduced to a minimum.

With these and other objects in view, the preferred embodiment of our invention resides in that construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and embraced within the scope of the appended claims.

In said drawings:—Figure 1 is an elevation of the complete apparatus for determining and permanently recording the water level in a boiler. Fig. 2 is a plan view of a modified form of the device, showing the same in position to operate an engine room indicator, and Fig. 3 is a similar view of another modification, showing its application for indicating the angle of a ship's rudder.

Similar numerals of reference are employed to designate corresponding parts throughout.

In carrying out the form illustrated in Fig. 1, we arrange to one side of a steam boiler a water column case (1) connected with the water space of the boiler (not shown) through pipes leading from the openings or ports (2) and (3). Supported to one side of the water column case (1) is a cylinder (4) terminating at the end remote from its head in an enlarged water tight crank case (5). Disposed within the cylinder (4) is a reciprocating piston (6) centrally provided with a wrist pin (7) on which is journaled one end of a piston rod (8). Movably fitted within the water column case (1) is a float (9) provided with an arm (10), the free end of which is keyed to one end of a shaft (11). The latter is journaled in one of the side walls of the water column case (1), and its opposite end enters the crank case (5) and terminates in a crank arm (12), the free end of which is connected by a crank pin (13) to the free end of the piston rod (8). Thus it will be seen when the water column (14) in the case (1) rises or descends and carries with it the float (9), the latter through the arm (10) will turn the shaft (11) and crank arm (12), and the latter by virtue of its connection with the piston rod will reciprocate the piston (6) within the cylinder (4). The construction just described will subsequently be termed the transmitting mechanism and is designed to operate through a hydraulic circuit and a similarly constructed piston, one or more indicators and a recorder. The latter and the indicators may be at a location remote from the boiler and disposed above or below the water space of the latter.

The recording cylinder (14′) is identical with the transmitting cylinder (4), and like the latter is closed at its head end and provided on the opposite end with an enlarged water tight crank case (15). The recording piston (16) reciprocates within the cylinder 14 and is centrally provided with a wrist pin 17 on which is journaled one end of a piston rod (18). A visual gage or indicator is shown as being of substantial U-shape, and is formed of glass and metal tubing. The metallic arm (19) is adjacent one end curved outwardly and rearwardly as shown at 20, and one end of the glass arm (21) is connected to this curved end by a coupling sleeve (22), provided with suitable packing and washers (23) at its opposite ends so as to form a water tight connection. The open end of the metallic tube (19) is provided with a filling funnel (24), and the corresponding end of the glass tube is provided with a cap (25) having an air vent (26). Connection between the metallic tube (19) and the rear or head end of the

transmitting cylinder 4 is established by means of a pipe line (27), one terminal of which is threaded into or otherwise secured to the base of the filling funnel (24) the opposite end fitting into the stem of a T-joint (28). Leading from one end of the latter is a pipe (29) connecting with the outer end of a pipe (30), the inner end of which is threaded into the cylinder wall adjacent the head. Connection between the glass arm 21 and crank case 5 is effected in a similar manner by means of a pipe line (31), one end of which is threaded into the cap (25), the opposite end terminating in a T-joint (32), from the outer end of which leads a pipe (33), connecting with the outer end of a pipe (34), the inner end of which is threaded into the crank case (5). Thus it will be seen that the circuit between the visual gage and transmitting piston is completed. Now when each arm of the visual gage is half filled with a column of mercury for instance, and the balance of the circuit including the space on both sides of the piston (6) and in the tubes 19 and 21 with a liquid of less specific gravity, such as oil, it can be seen that a movement of the piston caused by a rise or fall of the water in the boiler, as before described, will depress the column of mercury in one of the tubes. It is to be understood that the glass arm (21) will be proportioned to the gage glass of the boiler, and the mass of the float sufficient to force the column of mercury completely out of the glass tube which will be the case when the water in the boiler descends below the danger mark. At the junction of the pipes (29) and (30) an air cushioned expansion chamber (35) is provided to take up the change of volume of the liquid in the pipes due to change in temperature. A similar air chamber 36 is provided at the junction of the pipes (33 and 34) for the same purpose. The pipe lines 27 and 31 are connected by a coupling (37), the opposite ends of which are fitted into the inner ends of the T-joints (28 and 32). The coupling 37 is provided with a valve (38) which when opened serves as a means for adjusting the liquid of the circuit. The liquid is introduced through the funnel (24), and the latter is provided in its base with a three way cock (39) having the usual T-shaped opening. The cap (25) is provided with a similar cock (40). Thus it can be seen by turning the cocks in one direction the mercury may be first introduced and then by bringing the openings of the cocks into registration with the terminals of the pipe lines the operating liquid can be inserted. Connection between the crank case (15) and recording cylinder (14′) and the line (27) leading from the funnel to the cylinder 4 is made by the cross connections (41 and 42), and disposed in the pipe line (27) between the cross connections is an adjusting valve which is normally closed, and since the cylinder (14) and crank case (5) are each filled with liquid a rear movement of the transmitting piston will produce an opposite or outward movement of the recording piston whereby the liquid in the crank case will be forced through the cross connection (41) and into the metallic tube (19), and an opposite movement of the transmitter will produce an opposite effect, as will be obvious.

Disposed adjacent the recording cylinder (14′) is a recording dial (43) actuated by a suitable clock work mechanism (not shown) and journaled in the crank case 15 is a shaft (44). A crank (45) has one end keyed to the shaft and its opposite end journaled on the crank pin (46) and the free end of the piston rod (18). One end of the shaft 44 extends through the crank case and has keyed thereto a pointer (47) carrying at its free end a pen which bears on the face of the dial (43) leaving a curve showing the water level in the boiler at all times of the day.

An electrically operated indicator is disposed in any convenient place remote from the boiler for instance in the engine room and in the present instance is shown to consist of a voltmeter (48) and a resistance coil (49). The latter is disposed adjacent the transmitting mechanism and keyed to one end of the shaft (11) projecting beyond the crank case (5) is one end of a lever (50), the free end of which is provided with a shoe (51) which bears on the resistance coil (49). One pole of a suitable battery 52 is connected to one end of the resistance coil 49 and the other pole is connected to the other end of the coil and a connection is made between one end of the coil and the indicator 48 and the circuit is completed through the conductor 53 and the sliding contact arm 50 and contact 51. Thus it will be seen when the shaft (11) is turned by the piston as before described the shoe (51) will move along the coil (49) and a rise or fall of potential, according to the direction of movement of the lever, will be shown on the voltmeter, the scale of which is graduated to show the inches of water in the boiler.

In Fig. 2 is shown a modified form of the device used in connection with a bridge and engine room indicator, such as are employed on steam vessels. In the present instance the recording cylinder (54) is disposed within the engine room. This cylinder is provided on one end with an enlarged water tight crank case 55, similar to the type already described, a reciprocating piston (56) is within the cylinder centrally provided with a wrist pin (57) on which is journaled one end of a piston rod (58).

Journaled in the crank case (55) is a shaft (59) having keyed thereto one end of a crank arm (60), the opposite end of which is journaled on the crank pin (61) carried by the free end of the piston rod (58). Keyed to one end of the shaft (59) projecting beyond the crank case (55) is a toothed wheel (62), and disposed adjacent the outer face of the crank case is the usual arcuate plate (63) having inscribed spaces on its face in which are marked "Ahead", "Astern", etc. A spindle (64) journaled in the crank case 55 has keyed on one end projecting beyond the said crank case, a pinion (65) which meshes with the toothed wheel (62). A pointer (66) has one end keyed to the opposite end of the shaft projecting beyond the crank case (55) and its free end disposed over the spaced surface of the plate (63). The transmitting cylinder (64′) is arranged on the bridge of the vessel, and is provided on one end with an enlarged water tight crank case (65′) of the kind already described. A transmitting piston (66′) reciprocates within the cylinder (64′) and is centrally provided with a wrist pin (67), on which is journaled one end of a piston rod (68). Journaled in the opposite sides of the crank case is a shaft (69) having keyed thereto one end of a crank (70), the opposite end of which is journaled on a crank pin (71) carried by the free end of the piston rod (68). On one end of the shaft (69) projecting beyond the crank case is keyed a toothed wheel (72). An arcuate plate (73) having inscribed on one face readings corresponding to those on the engine room plate (63) is supported adjacent the crank case (65′) and journaled in the latter adjacent the shaft (69) is a spindle (74) having keyed on one end projecting beyond the crank case, a pinion (75), which meshes with the toothed wheel (72), and keyed to the opposite end of the spindle beyond the crank case is an operating arm (76) which extends across the face of the plate (73). A connection is established between the crank cases 55 and 65 by means of a pipe line (77), and a similar pipe (78) connects the cylinders 54 and 64′. Thus it will be seen when the spaces in the crank cases, cylinders, and the pipes are filled with liquid as before described a movement of the operating arm (76) to one of the spaces on either side of the central space will cause the transmitting piston to move inwardly or outwardly, and an opposite movement is thereby imparted to the piston (56) and pointer (66). It is to be understood that the reading on the engine room plate or dial 63 corresponds with the reading on the bridge dial 73, and when the indicator upon the bridge dial is pointing to the right of the central space thereof, the indicator on the engine room dial will also be pointing to the right of the central space upon its dial.

Fig. 3 shows another modification wherein the cylinders are connected with the rudder post and a bridge dial, the latter indicating any movement of the former. In this construction, the transmitting cylinder (79), with its crank case (80), piston (81) and piston rod (82) are disposed in the after part of the vessel adjacent the rudder post (not shown). A shaft (83) is journaled in the crank case (80) and is connected with the free end of the piston rod by a crank (84), as before described. On the outer end of the shaft is keyed a toothed wheel (85). A spindle (86) is similarly journaled in the crank case, and is also provided on one end with a pinion (87) meshing with the toothed wheel (85), and on the opposite end is rigidly fitted to the middle of a cross bar (88). Connection between the ends of the latter and a similar bar (not shown) on the rudder post is effected by rods (89). The recording cylinder (90), with its crank case (91), piston (92) and piston rod (93), is arranged in a suitable position on the bridge or in the pilot house.

Like the construction just described, the crank case is provided with a shaft (94) having a crank (95), one end of which is connected to the free end of the piston rod, and is also provided on its outer end with a toothed wheel (96). A suitable dial (97) graduated on one face with degree marks is disposed adjacent the crank case (91), and journaled in the latter is a spindle (98) having keyed to one end beyond the crank case, a pinion (99) which meshes with the toothed wheel (96). A pointer (100) is keyed to the opposite end of the spindle, and moved over the graduated face of the dial (97). The crank cases 80 and 91, and cylinders 79 and 90, are connected by the pipe lines (101 and 102), respectively. When the cylinder crank case spaces, and the pipes are filled with liquid, as before described, it can be seen how any angle to which the rudder is moved will be instantly indicated on the dial (97).

From the foregoing it can be seen that we have provided a construction which can be applied to various uses without departing from the spirit of the invention.

What we claim as new is:—

1. A means for determining the water level in a boiler or the like, comprising a cylinder having at one end an inclosed crank case, a piston and piston rod in said cylinder, an indicator and recorder connected with said piston rod, a second cylinder having an inclosed crank case, and a transmitting piston and piston rod combined with said second named cylinder, a hydraulic circuit connecting the said cylinders and crank cases, and a connection between the trans-

mitting piston rod and the water column of the boiler whereby a rise or fall of the latter will operate said indicator and recorder through the circuit and pistons.

2. In a device for determining the water level in a boiler, a plurality of cylinders each of which is provided with a closed crank case, and a piston and piston rod, a water column, a float positioned therein, a hydraulic circuit connecting the said crank cases and cylinders, a connecting means interposed between one of said cylinders and said float in said water column, and a recorder and indicator coöperating with another of said cylinders, and operated by the latter through the said circuit and first named piston rod.

3. In a device for determining the water level in a boiler or the like, comprising a plurality of gages and a recorder, a plurality of cylinders each of which is provided with a closed crank case, a piston and piston rod, a hydraulic circuit connecting the said crank cases and cylinders, a connection between said piston rods and the recorders, connecting means between said cylinders and gage, and means coöperating with one of said piston rods and adapted to operate the same whereby when a rise or fall of water in the boiler or water column occurs it will be indicated by the recorder and gage through the circuit and pistons.

4. The combination with an indicator of a plurality of cylinders each of which is provided with a closed crank case, a piston and piston rod, a hydraulic circuit connecting the said crank cases and cylinders, a connection between one of said piston rods and the indicator, and means for transmitting movement to another of said piston rods whereby the indicator is actuated through the circuit and the first named rod.

5. In an indicator, the combination with a plurality of mechanically operated recorders and a gage glass, of a plurality of cylinders each of which is provided with an inclosed crank case, a piston and piston rod, a hydraulic circuit connecting the said cylinders, crank cases and gage glass, a pointer for said recorders and a connection between said pointer and piston rods, and means for transmitting movement to one of said piston rods whereby the movement is indicated by said gage glass and recorder through the said circuit.

6. In a device of the class described, the combination with an indicator and a recorder, of a plurality of casings, pistons working within said casings, a water column case, a float positioned therein, a pointer connected to said float, a piston rod connected at one end to said piston, and means connected to the other end of said piston rod and said float and pointer for reciprocating said piston and swinging said pointer when said float is raised or lowered with the height of the water contained within the water column case.

7. In a device of the class described, the combination with an indicator and a recorder, of a plurality of casings, a water column case contiguous to said casings, pistons working within said casings, means connecting said casings, means coöperating with one of said pistons within one of said casings for reciprocating the other piston in the other casing when said first-mentioned piston is operated, a rotating dial, a pointer coöperating with said last-mentioned piston, and means carried by the outer end of said pointer and engaging said rotating dial for recording the height of the water within said water column case.

8. In a device of the class described, the combination with a plurality of casings, means connecting said casings, of a gage communicating with said connecting means, said gage adapted to contain liquid, and means positioned in one of said casings whereby when said means are actuated said indicator and recorder will also be actuated through the medium of said gage and connecting means between said casings.

9. In a device of the class described the combination with a plurality of casings, plungers positioned therein, of a water column casing, a float positioned therein and coöperating with one of said plungers, a contact arm coöperating with one of said plungers and said float and adapted to be actuated thereby, and electrical means cooperating with said contact arm for indicating the height of the water level within said water column casing.

10. In a device of the class described the combination with a plurality of casings, plungers positioned therein, a water column casing, a float positioned therein, of a contact arm coöperating with one of said plungers and said float and adapted to be actuated thereby, a contact plate carried by one end of said contact arm and a resistance coil, said contact plate adapted to engage said resistance coil, and a voltmeter electrically connected to said contact arm and said resistance coil whereby when said contact arm moves upon said resistance coil said voltmeter will indicate the height of the water within the water column casing.

11. In a device of the class described the combination with a plurality of casings, plungers positioned therein, a water column casing, a float positioned therein, of a contact arm coöperating with one of said plungers and adapted to be actuated thereby, a resistance coil, a metallic circuit having its terminals connected to the respective ends of said resistance coil, a contact plate carried by the outer end of said contact arm, and adapted to travel over said resistance

coil for increasing and decreasing the difference of potential between the poles of said circuit, a voltmeter, means electrically connecting said contact arm and one end of said resistance coil to said voltmeter, and said voltmeter adapted to be actuated when said arm is swung upon said resistance coil.

In testimony whereof we hereunto affix our signatures in presence of two witnesses.

ROLLO B. FRYETT.
HENRY H. BOTTEN.

Witnesses:
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J. W. BRYAN.