

Jan. 4, 1938.

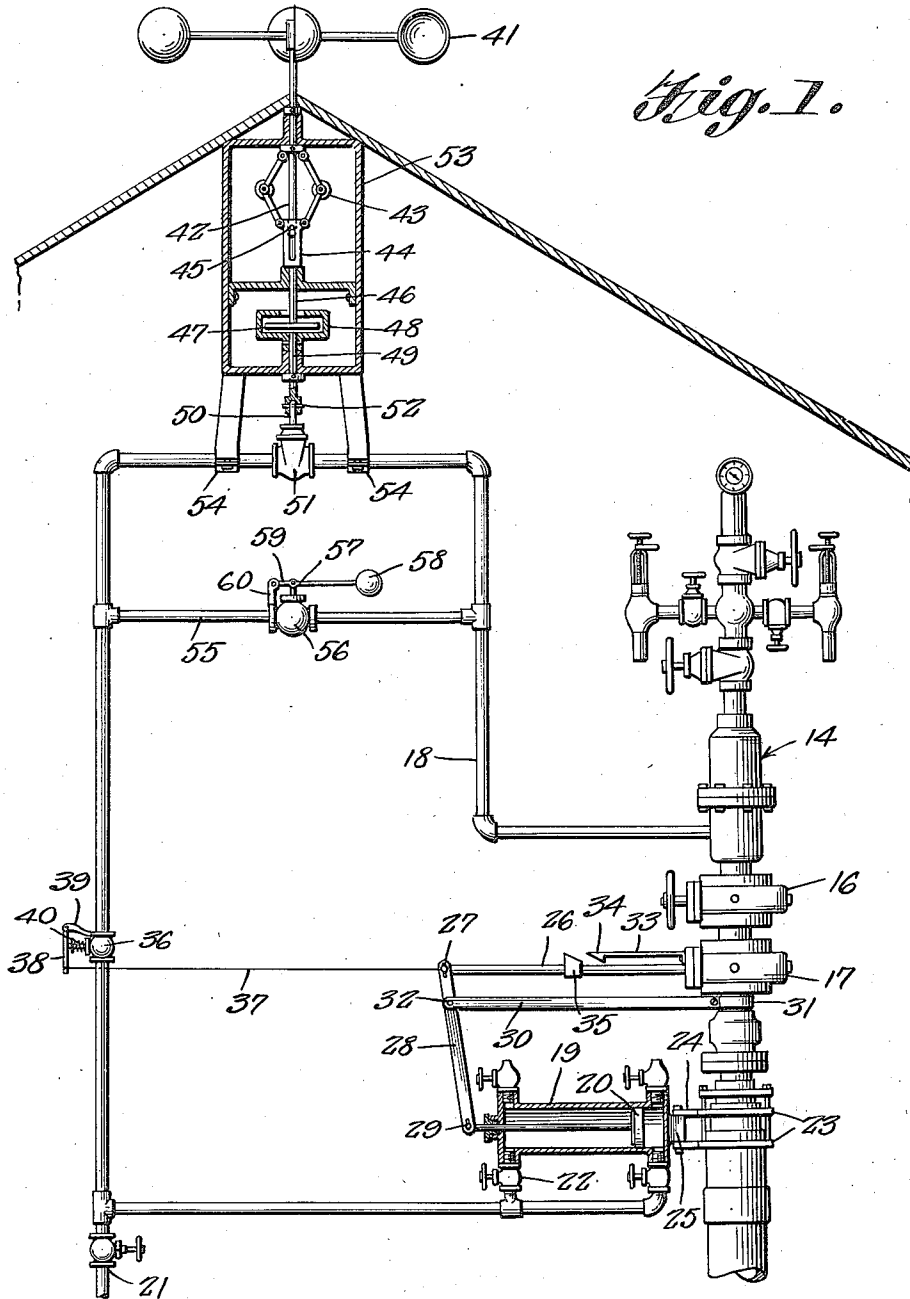
A. B. LONG ET AL

2,104,660

OIL AND GAS WELL PROTECTIVE DEVICE

Filed May 10, 1937

3 Sheets-Sheet 1



P. St. Aubrey
WITNESS

*Alfred B. Long,
Louis E. Stagg, Jr.*
INVENTORS
BY *Victor J. Evans & Co.*
ATTORNEYS

Jan. 4, 1938.

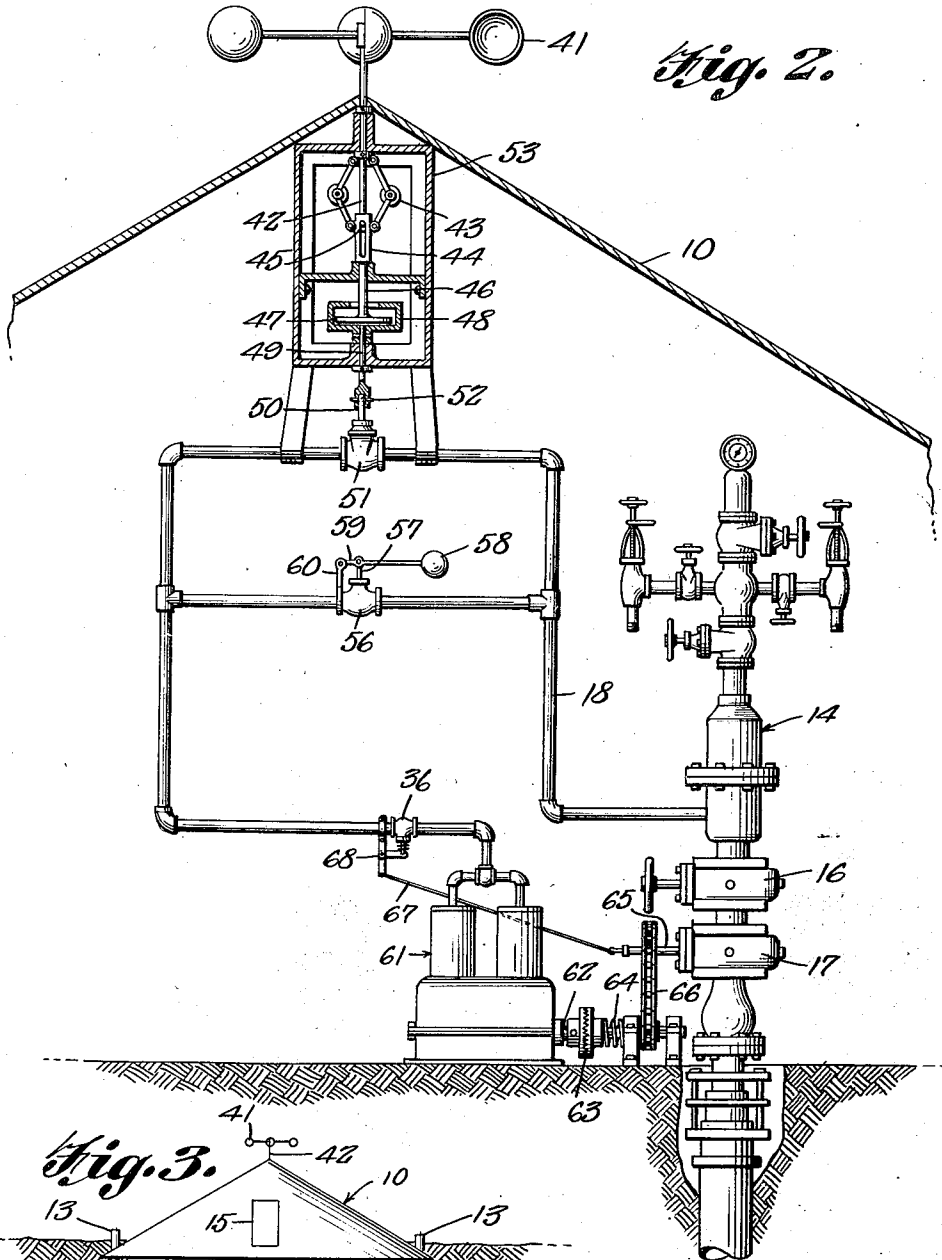
A. B. LONG ET AL

2,104,660

OIL AND GAS WELL PROTECTIVE DEVICE

Filed May 10, 1937

3 Sheets-Sheet 2



P. E. Hickey
WITNESS

*Alfred B. Long,
Louis E. Stagg, Jr.,*
INVENTORS

BY *Victor J. Evans & Co.*
ATTORNEYS

Jan. 4, 1938.

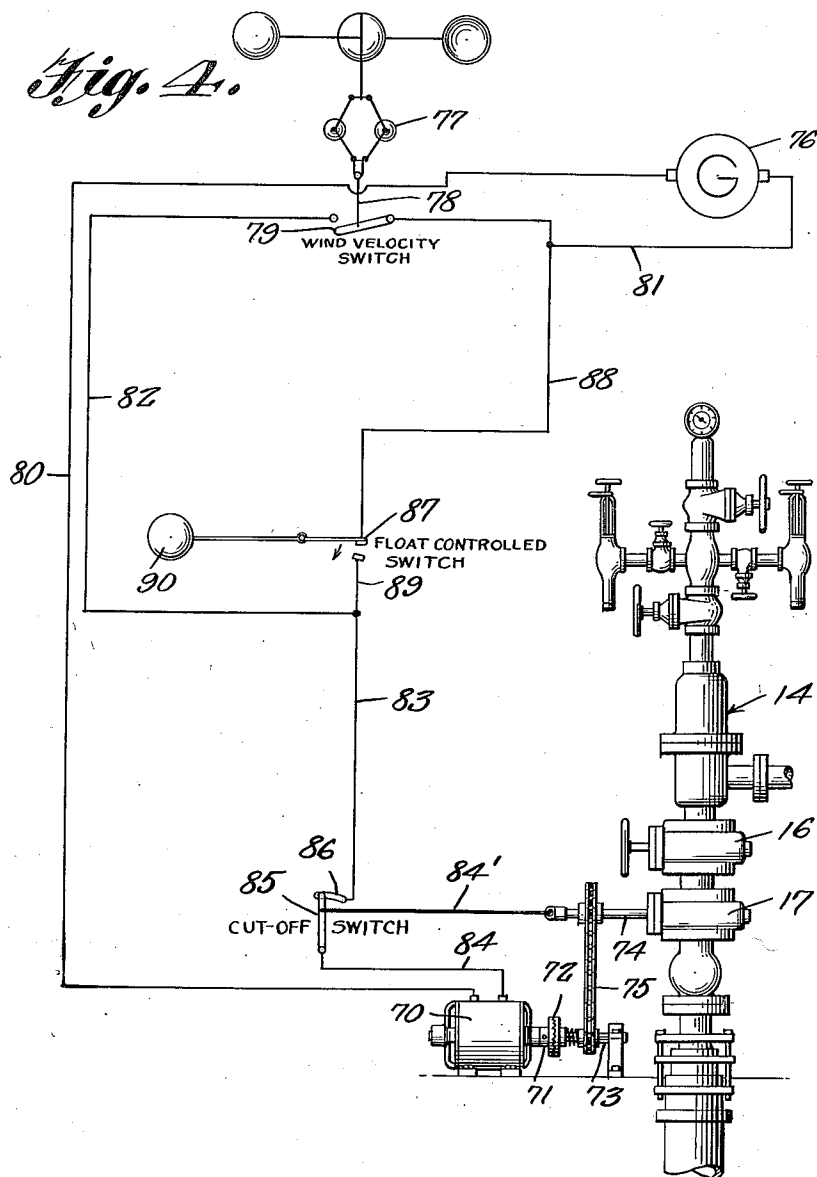
A. B. LONG ET AL

2,104,660

OIL AND GAS WELL PROTECTIVE DEVICE

Filed May 10, 1937

3 Sheets-Sheet 3



P. B. Hickey

WITNESS

*Alfred B. Long,
Louis E. Stagg, Jr.,*

INVENTORS

BY *Victor J. Evans & Co.*

ATTORNEYS

UNITED STATES PATENT OFFICE

2,104,660

OIL AND GAS WELL PROTECTIVE

Alfred B. Long and Louis E. Stagg, Jr., Beaumont, Tex.

Application May 10, 1937, Serial No. 141,849

10 Claims. (Cl. 166—15)

This invention relates to an oil and gas well protective device.

An object of this invention is to provide a protective device for high pressure oil and gas wells located in areas that are subject to severe storms or flood conditions or both.

Deep wells have a potential of from 10,000 to 20,000 barrels per day and a gas pressure of from 500 to 3,000 pounds. To bring a well under control after it once has gotten loose is a very difficult and dangerous undertaking and also requires time. It is therefore evident that much loss and damage can take place in even the short period of a few hours. Also in such event the oil well reservoir gas pressure would be greatly reduced and cause other wells in the immediate vicinity to stop flowing. The ultimate recoverable potential of the field would therefore be greatly reduced. The present invention is designed to prevent the oil well "Christmas-tree" from being damaged and also to automatically cut off the flow of gas and oil as a further precaution under dangerous wind and water conditions.

To achieve the above ends the invention comprises means for closing the master valve and stopping the flow of oil or gas from the well before there is a possibility of loss due to wind or water damage. After the master valve has been closed it must be re-adjusted manually therefore making it possible to locate and repair such damage as may occur to connecting lines or other equipment before the well is allowed to flow again.

A further object is to provide a covering or shelter as a unitary assembly with the valve closing mechanism. With the use of a shelter alone damage could occur to connecting pipe lines and other equipment located out in the field, resulting in loss of oil and gas. In the event of high water conditions it might be impossible to reach and enter the protective covering to close the master valve manually. Were the valve closing mechanism installed alone and unsheltered it might be possible for damage to occur to the "Christmas-tree" and connecting pipe lines and equipment located near to and in connection with the well due to the washing action of high water which tends to destroy supports and footings, and due to high winds and waves which carry loose timbers and other debris along at dangerous velocity.

With the above and other objects in view the invention consists of certain novel details of construction and combinations of parts herein-after fully described and claimed, it being under-

stood that various modifications may be resorted to within the scope of the appended claims without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings forming part 5 of this specification,

Figure 1 is a longitudinal sectional view, with parts in elevation, of an oil and gas well protective device, constructed in accordance with the invention and showing a pressure operated piston and lever for closing the master valve of the oil well "Christmas-tree", the closing of the valve being timed by a wind turbine and/or float valve.

Figure 2 is a view similar to Figure 1 but showing a pressure operated motor in lieu of the piston and lever for closing the master valve.

Figure 3 is a side elevation of one type of protective covering for the well "Christmas-tree".

Figure 4 is a view in elevation showing an electric motor for closing the master valve and showing the wiring, controlling switches and timing wind turbine and float diagrammatically.

Referring now to the drawings in which like characters of reference designate similar parts in the various views, and more especially to Figure 3, 10 designates in general a protective covering of such shape and size as to offer the least resistance to wind and wave action. A conical covering is preferable although other shapes may be utilized if desired.

The protective covering may be formed of sheet metal or other material and may be constructed to set upon the surface of the ground with the cover extending into the ground or may be provided with a cellar wall 11 sunk below the surface of the ground, as shown at 12. In either case it is anchored by piling 13 or other means depending upon the nature of the soil. The protective covering is built over the "Christmas-tree" connections of the well, designated in general by the numeral 14, so as to amply protect all well outlet connections from damage due to wind and water, and is provided with a door 15 through which access may be had to the "Christmas-tree". The "Christmas-tree" is equipped with the usual manually operated master shut off valve 16.

In carrying out the invention the "Christmas-tree" is also provided with an automatic master shut off valve 17 which may be of the plug type as illustrated in Figure 1 and closed by straight line movement, or may be of the feed screw type closed by turning movement as shown in Figures 2 and 3.

The automatic master valve may be closed by

pressure from the well and for this purpose, as shown in Figure 1, the pipe 18 may be connected at one end to the "Christmas-tree" above the manually operated shut off valve 16 and at the other end may be connected to one end of a cylinder 19 in which the well pressure may be directed against a piston 20 to move the piston toward the opposite end of the cylinder. A valved pipe 21 is connected to the pipe 18 and connected to an outside source of pressure to admit pressure through a pipe equipped with a reversing valve 22 into the opposite end of the cylinder to reverse movement of the piston for resetting the piston after each operation. The cylinder may be mounted on the "Christmas-tree" by a clamp 23 having ears 24 which are bolted to a lug 25 on the cylinder head.

The stem 26 of the automatic master valve 17 is elongated and is terminally pivoted as shown at 27 to one end of a rock lever 28, the opposite end of which is terminally pivoted as shown at 29 to the rod of the piston. A bracket arm 30 is clamped to the "Christmas-tree" by means of a split ring clamp 31, or other connection, and is terminally pivoted to the rock lever 28 as shown at 32 to mount the rock lever.

When pressure is admitted to the cylinder through the pipe 18 the rock lever will move the valve stem 26 in a rectilinear direction and close the valve. For maintaining the valve closed a spring finger 33 extends forwardly from the automatic valve along the valve stem and is equipped with a hook 34 which rides over and engages a stop collar 35 on the valve stem so that the stem cannot be moved outward to open the valve until pressure from an outside source is admitted to the piston cylinder by opening the reversing valve 22 thus giving plenty of time to repair such damage as may occur to connecting lines or other equipment due to wind or weather before the well is allowed to flow again.

A shut off valve 36 is located in the pipe 18 at a point preferably adjacent the master valve stem 26. A cable 37 connects the master valve stem with an operating lever 38 which is pivoted on a bracket arm 39 carried by the shut off valve. The valve stem 40 is connected to the lever. When the master valve is being closed the cable 37 will be pulled and move the lever 38 to close the shut off valve just as the master valve becomes completely closed so that well pressure will be shut off from the cylinder 19.

Well pressure is let into the cylinder through the pipe 18 upon either dangerous wind pressure or high water. The timing apparatus operated by the wind comprises a wind driven turbine 41, or other wind actuated device, mounted on top of or in connection with the protective covering 10. The shaft 42 of the wind turbine is equipped with a fly ball governor 43, the sliding sleeve 44 of which engages a pin 45 on the shaft. The sleeve is formed integral with a clutch shaft 46 that terminates in a clutch disc 47 which, at dangerous wind velocity when the balls 43 fly outwardly, move up and engages a clutch casing 48 to rotate the casing.

The casing 48 is pinned to a shaft 49 which is connected to the stem 50 of a starting valve 51 by means of a shear pin 52. When the clutch parts 47 and 48 are engaged the valve stem 50 will be rotated by the wind turbine to turn the valve stem 50 and open the valve. When the valve is completely opened the shear pin 52 will break so that the valve will not be damaged when the turbine is turning at high speed.

A suitable casing 53 houses the fly ball governor and the clutch and this casing may be secured to the pipe 18 by a bracket arm 54 or may be otherwise attached to the protective covering 10.

In operation when the wind reaches dangerous velocity the fly ball governor will engage the clutch parts 47 and 48 to open the starting valve 51 and admit pressure from the "Christmas-tree" through the pipe 18 into the end of the cylinder 19 and against the piston 20. Movement of the piston under influence of well pressure will rock the rock lever 28 and move the automatic master shut off valve stem 26 to close the valve. The hook 33 hooks over the stop 35 when the valve is completely closed and prevents the valve being opened until the reversing valve 22 is manually opened to admit pressure from an outside source against the piston in the cylinder to move the piston to its initial starting position.

Well pressure may be admitted to the pipe 18 to close the master automatic shut off valve upon a dangerous rise in water level. For this purpose a by-pass pipe 55 is connected to the pipe 18 to by-pass well pressure from the "Christmas-tree" 14 to the piston cylinder 19 around the starting valve 51. A starting valve 56 is located in the by-pass pipe 55 and the stem 57 of the valve is actuated by a float 58 and lever 59 which latter is pivoted to a bracket arm 60 that is mounted on the pipe 55. Dangerous high water level will lift the float and open the float controlled starting valve 56 to admit well pressure through the pipe 18 to the piston cylinder 19.

In Figure 2 the parts described in connection with the description of Figure 1 are duplicated and hence have been given similar reference numerals, with the exception that in lieu of the pressure operated piston and lever mechanism for closing the master shut off valve 17, a conventional pressure operated motor 61 is employed. The shaft 62 of the motor is connected by a toothed slip clutch 63 to a stub shaft 64 which is connected to the stem 65 of the master shut off valve 17 by a chain drive 66. When pressure is let into the pipe 18 by operation either of the wind turbine controlled starting valve 51, or the float controlled starting valve 56, the motor will be started and through the chain drive will rotate the valve stem 65 to close the master shut off valve. When the valve is completely closed the clutch 63 slips after the pressure has been shut off from the motor, as will be presently described, to keep the momentum of the motor from damaging the master shut off valve by the sudden tightening of the valve when the same closes completely.

Of course, the chain drive 66 will move toward the master shut off valve 17, by virtue of the lower chain drive pulley being splined on the stub shaft 64 when the valve is closing and this movement is utilized to close the shut off valve 36 hitherto described and shut off the well pressure from the motor. For this purpose a cable 67 is connected to the pivoted operating lever 68 of the shut off valve 36 and is connected to the stem 65 of the master shut off valve by a universal joint 69. Endwise shifting movement of the master valve stem 65 during closing of the valve pulls the cable 67 to close the shut off valve 36 at the moment the master shut off valve is completely closed and shut off the well pressure from the motor 61.

In Figure 4 the automatic shut off valve of the

"Christmas-tree" is illustrated as being closed by an electric motor 70 rather than through well pressure. The shaft 71 of the motor is connected by a slip clutch 72 to a stub shaft 73 which latter is connected to the stem 74 of the master shut off valve by a chain drive 75 similar to the chain drive hitherto described.

The energizing current from the motor may be furnished by a generator 76 of any preferred type and driven from any preferred source of power. A wind actuated device 77, preferably of a type similar to the wind turbine hitherto described, is illustrated diagrammatically as having a pull rod 78 connected with a swinging contact 79 of a wind pressure operated switch which controls the motor circuit comprising wires 80, 81, 82, 83 and 84. When the wind reaches dangerous velocity the motor circuit will be automatically closed by the operation of the fly ball governor on the wind turbine 77 to start the motor which actuates the chain drive 75 to turn the valve stem 74 and close the master shut off valve 17. A cable 84 is connected to the movable switch contact 85 of a cut off switch 86 in the motor circuit and is connected to the valve stem 74. When the valve stem is moved inward to close the valve the cable will pull open the movable switch contact 85 and open the circuit to stop the motor. Slipping of the clutch 72 prevents breakage of the parts of the master valve due to momentum of the motor after the motor energizing circuit is opened.

A float controlled switch 87 is located in shunt circuit with the motor circuit heretofore described, the shunt circuit wires being designated by the numerals 88 and 89. Upon dangerous increase in water level the float controlled switch will be closed by raising of the float 90 to close the shunt circuit from the generator to the motor and start the motor to close the master shut off valve as described.

From the above description it is thought that the construction and operation of the invention will be fully understood without further explanation.

What is claimed is:

1. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of means for housing the "Christmas-tree", and means for automatically shutting off the valve upon a predetermined wind velocity or rise in water level.

2. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of means for automatically shutting off the valve upon predetermined wind velocity, means for automatically shutting off the valve upon a predetermined rise in water level, means for holding the valve closed, and a covering for protecting the "Christmas-tree" and all of said means from injury.

3. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of a protective covering to house the "Christmas-tree", a pressure cylinder, a piston in the cylinder connected to the shut off valve, a pipe for conducting well pressure to one end of the cylinder against the pis-

ton to shut off the valve and means for admitting pressure through the pipe into the cylinder upon a dangerous rise of wind and water conditions.

4. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of a protective covering for the "Christmas-tree", means for utilizing well pressure to close the valve, a wind actuated device connected to said means for actuating said means upon a dangerous rise in wind velocity, and a float controlled means connected to the first named means for actuating the first named means upon a dangerous rise in water level.

5. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of a protective covering for the "Christmas-tree", a pressure operated motor connected to the shut off valve for shutting off the valve, a pipe connected to the "Christmas-tree" and to the motor for utilizing well pressure to actuate the motor, wind actuated means for admitting pressure to the pipe upon a dangerous rise in wind velocity, and float operated means for admitting pressure to the pipe upon a dangerous rise in water level.

6. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of a protective covering for the "Christmas-tree", an electric motor connected to the valve for closing the valve, a circuit for the motor, a source of electricity for supplying current to the motor, a wind operated switch for closing the motor circuit upon a dangerous rise in wind velocity and a float operated switch in the circuit for closing the circuit upon a dangerous rise in water level.

7. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of means for housing the "Christmas-tree", and wind operated means connected with the valve for automatically shutting off the valve upon a dangerous rise in wind velocity.

8. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of means for housing the "Christmas-tree", and float operated means connected with the valve for shutting off the valve upon a dangerous rise in water level.

9. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of means for housing the "Christmas-tree", electrically operated means connected to the valve for automatically shutting off the valve, and means for timing the actuation of the first named means to occur upon a dangerous rise in water level.

10. An oil and gas well protective device comprising the combination with the well "Christmas-tree" having a shut off valve, of means for housing the "Christmas-tree", electrically operated means connected to the valve for automatically shutting off the valve, and means for timing the actuation of the first named means to occur upon a dangerous rise in wind velocity.

ALFRED B. LONG.

LOUIS E. STAGG, JR.