WELL CASING DETECTOR

by

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I
PURPOSE

When figures on the length of steel casing in wells are unavailable, some means of determining this length is necessary. In replacing this casing of a well, or even selling the property the well is on, the length has to be known; either for ordering the new material, or for setting a value on the well.

The purpose of this thesis is to devise and develop some practical method for determining the length of casing in wells.

II

THEORY

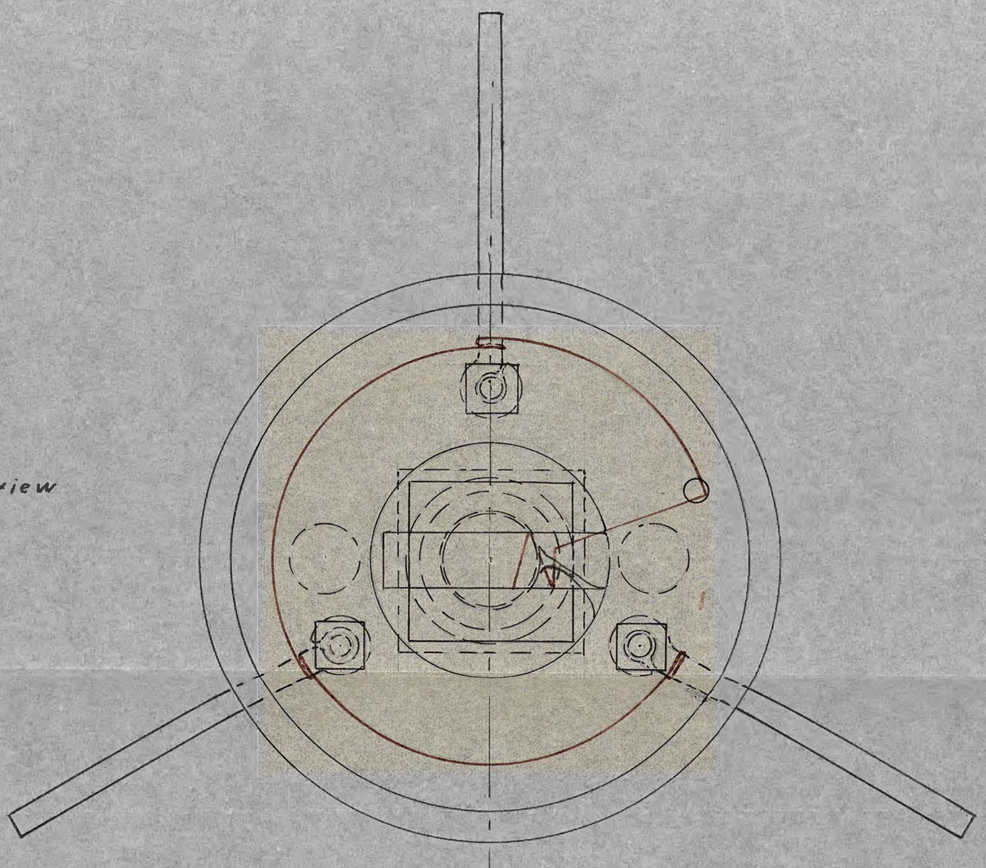
When there exists a potential difference between two bodies a current will flow from the one of high potential to the one of low potential, when a circuit is complete. The circuit of the bodies and contact points offer a resistance which abeys Ohms law, i.e., the potential difference is equal to the current flowing times the resistance of the circuit over which the potential drop is measured.

$E = IR$ symbolically represents the above law when E is equal to the potential difference in volts, I is equal to the current flowing in amperes, and R is equal to the resistance in ohms of the circuit between the potential drop.

The above facts were used in designing a machine for measuring the length of casing in wells. When the machine slides down the casing (making contacts with the casing by bronze springs) the resistance of the circuit changes uniformly per unit of casing; but when the machine reaches the end of the casing and has only the water of the well as contact the resistance abruptly changes.

This abrupt change is what the operation of the machine hinges upon. When this change occurs it is shown in the indicating meter (ammeter) and the operator of the machine knows the end of the casing has been reached. By measuring the amount of rope, used in lowering the machine in the well until the change occurs, the length of the casing is determined.

Top view



WELL CASING DETECTOR

Scale 1" = 1"

Verticle view

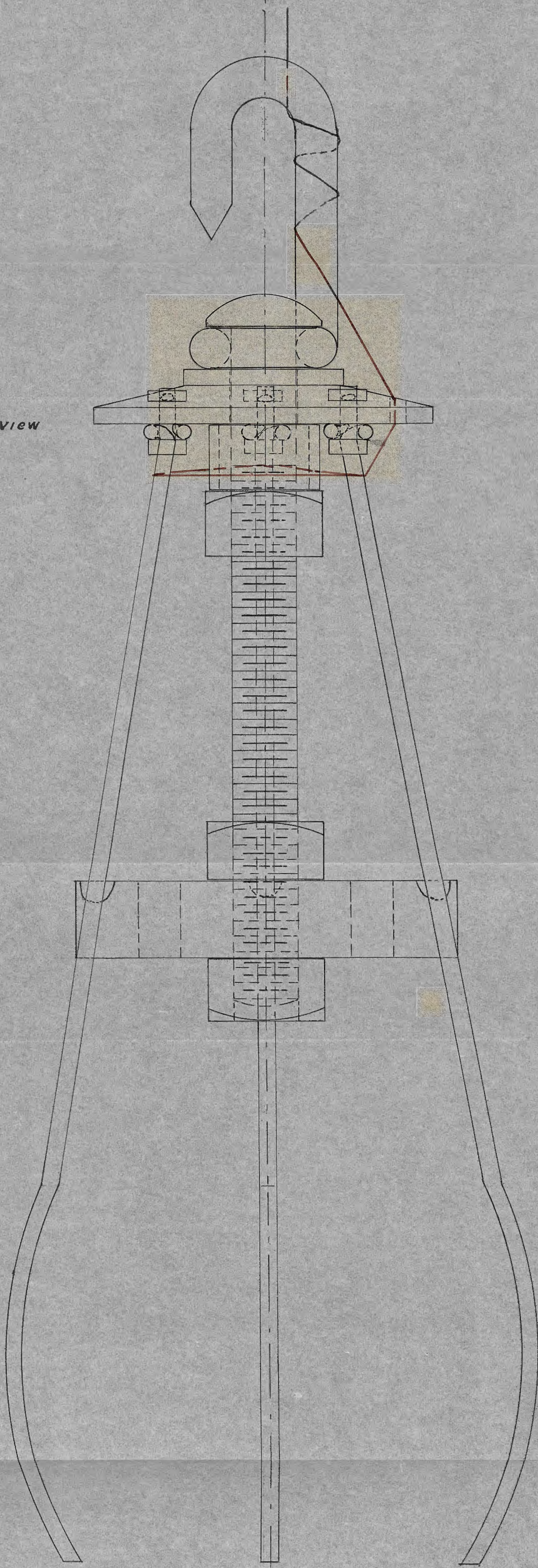


Figure 1

J.H.Evans.

III

APPARATUS AND DRAWINGS

The well casing detector is a machine designed, primarily to get a good electrical contact along the casing as it slides down into the well; and secondarily, designed with strength enough to be forced past any obstacle that may exist in the well against the casing.

It is built up around an eight (8) inch carriage bolt, along which all the downward force, and upward force, acts. At the top of the bolt a hook of one-half ($\frac{1}{2}$) inch steel is fastened, and against this hook a four (4) inch disc is clamped by a three-quarter ($\frac{3}{4}$) inch nut.

Fastened to this disc at one hundred and twenty (120) degree intervals are three (3),--three-sixteenth (3/16) inch bronze wires, fourteen (14) inches long. They are bolted to the disc by three-sixteenth (3/16) inch bolts. These bronze wires are the contacts of the circuit and are bent inward in a curved loop so they will not snag any rough projections on the casing.

At the lower end of the carriage bolt a four and one-half ($4\frac{1}{2}$) inch disc is held by two three-quarter ($\frac{3}{4}$) inch nuts. This disc touches all three of the bronze wires. By raising this disc along the carriage bolt by adjusting the two (2) lock nuts, the wires may be flared out to fit any size well casing from five (5) inches to twelve (12) inches in diameter.

The lower disc has two (2), one-half inch holes in it so that a weight can be hung on the machine to insure travel past any impediment.

The three (3) bronze contacts are connected to the electrical circuit by number fourteen (14) gage (B & S) copper wire, which passes around each contact wire and up thru the top disc. It is fastened around the hook to insure the connections against pull.

The detector may be lowered into the well by a cable of suitable strength, depending upon the roughness of the casing being tested.

A full size drawing of the detector is shown in figure I, page 6.

The supporting equipment for this detector consists of; one storage battery; one ammeter; one twenty pound weight not more than four inches in diameter; one coil of low resistance insulated wire of length enough to reach a reasonable distance past the approximate length of the casing being tested; and one measuring tape.

IV

METHOD OF PERFORMANCE

In running a test with the well casing detector to determine the length of casing in a well; first, assemble all the equipment necessary, that is;

a. One well casing detector.

b. One twenty pound weight.

c. Group of storage battery cells.

d. One ammeter.

e. One tape line..

f. Wire enough to reach end of casing.

g. Rope long enough to reach end of casing.

Second, connect dector, well casing, ammeter, and battery in series, as shown in figure 2, page 9.

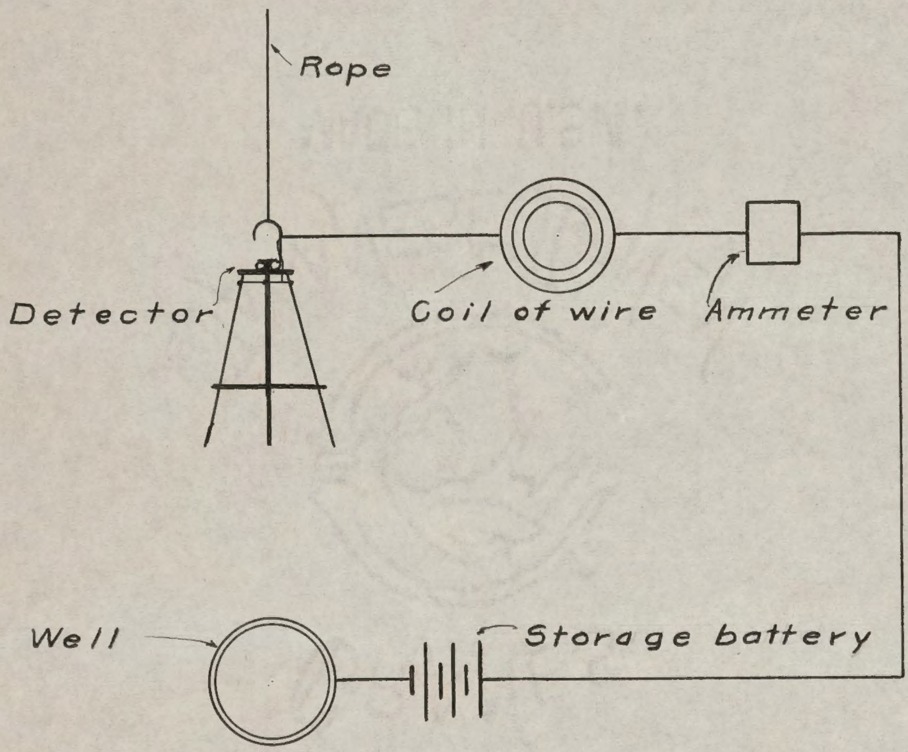
Third, adjust detector to fit size of casing.

Fourth, put the detector into the casing and lower slowly with the rope, at the same time feeding the wire as fast as the detector is lowered.

During the process of lowering the detector watch the ammeter closely, noting down the readings indicated at each foot of casing covered by the detector.

When the detector has passed thru the bottom end of the casing the ammeter will register a larger change in current than the readings taken at every foot lowered on the downward path show.

Fifth, when this change in the current is shown, mark the rope at the top of the well pull the detector up ten (10) feet,



Hookup for Well Casing Test

Figure 2

and lower again very slowly, reading the ammeter as before. Stop the detector just as the change occurs. Check the previous mark on the rope, pull up the detector and measure the rope from the mark to the detector contacts. This measured length of rope is also the length of the well casing.

V.

TRIAL TEST WITH DATA AND CURVES

A trial test was run with the detector in the Engineering College at Estabrook Hall, University of Tennessee, on a small improvised well consisting of a four (4) foot length of six (6) inch steel casing with the lower end submerged six (6) inches in a tank of water. Enough room was left under the pipe to allow the detector to pass completely through the length of casing. A pulley was rigged up over the casing and by this means the detector was lowered and raised through the casing.

The test was run first using a storage battery (6 volts). Readings were taken at every foot lowered.

The following table of data was recorded at the test:

Table I

Location of Detector	Amperes	Volts	Condition
Top	13.0	3.2	dry pipe
1 ft. down	12.6	3.2	dry pipe
2 ft. down	12.1	3.2	" "
3 ft. down	11.8	3.2	" "
3.5' down	11.6	3.2	water and pipe
4 ft. down	.5	4.0	½ ft. water

Test two was run with a direct current from D. C. generator with eighty (80) volts impressed. A rheostat was in series with the apparatus used.

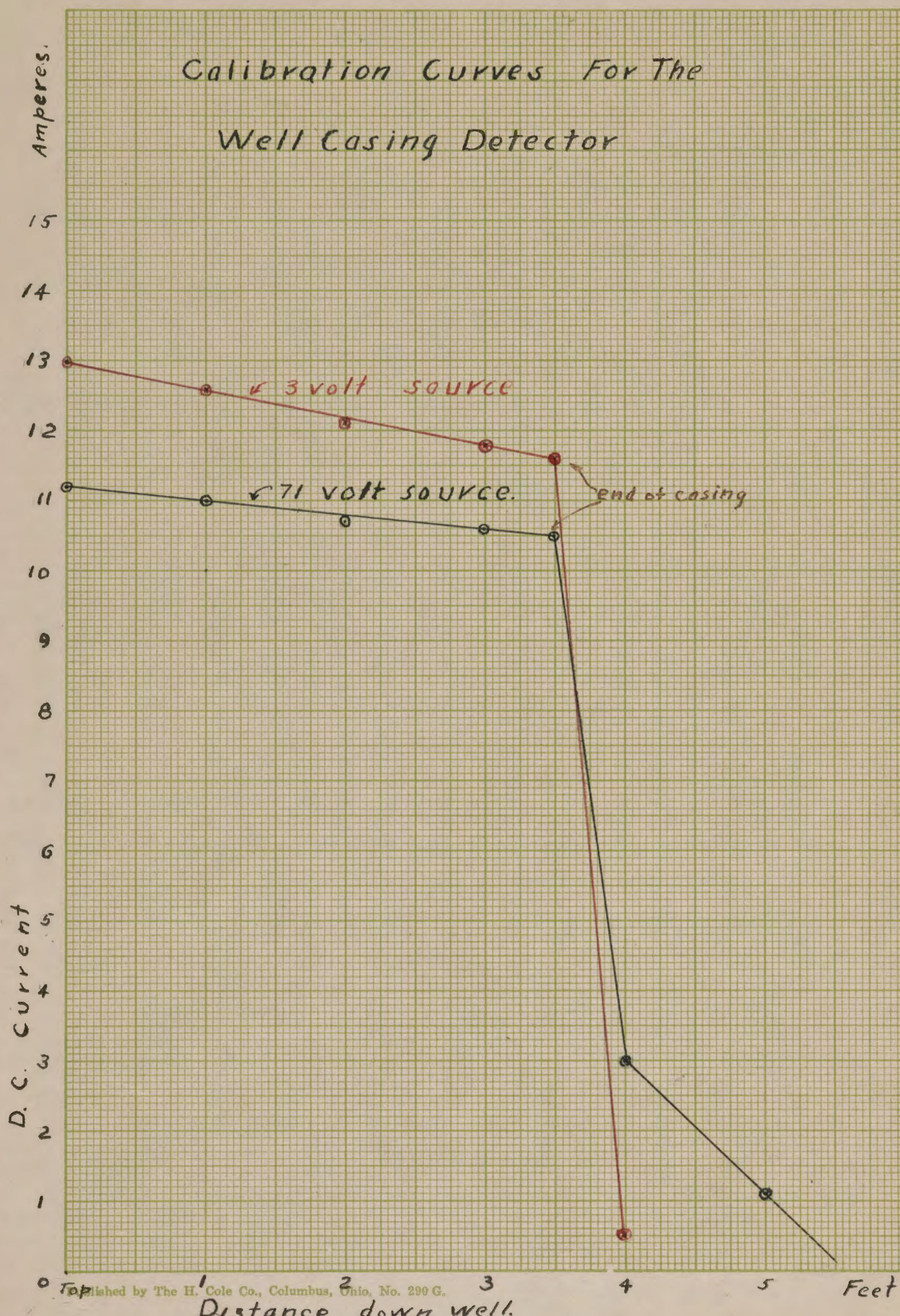
The following data was recorded:

Table II

Location of Dectector	Amperes	Volts	Condition
Top	11.2	71	dry pipe
1 ft. down	11.0	71	" "
2 ft. down	10.7	71	" "
3 ft. down	10.6	72	" "
$3\frac{1}{2}$ ft. down	10.5	72	water & pipe
4 ft. down	3.	82	$\frac{1}{2}$ ft. water
5 ft. down	1.1	82	$1\frac{1}{2}$ ft. water

From the data recorded in these two test runs, the action of the detector was calibrated and curves drawn showing the drops per unit length and the change that takes place at the end of the casing.

The following curves on page 13 are taken from tables I and II.


Calibration Curves For The
Well Casing Detector
Amperes.
D. C. Current
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
3 volt source
71 volt source.
end of casing
Top
1
2
3
4
5
Feet
Distance down well.
Published by The H. Cole Co., Columbus, Ohio, No. 290 G.

VI.

RESULTS AND CONCLUSIONS

The result of the trial test with the detector shows that the design worked out is feasible, both in theory and in practicable application. When the detector leaves the end of the casing in the well and is entirely in water the change of resistance is sufficiently great to cause an abrupt change in the current flowing in the circuit. The abrupt change being sudden enough to show, within two (2) inches, the end of the casing.

This detector has commercial possibilities as the initial cost is very reasonable, the operation simple, and is accurate as far as necessary in well casing work.

APPROVAL.

The foregoing thesis is hereby approved as a creditable study of an engineering subject, carried out and presented in a manner sufficiently satisfactory to warrant its acceptance as a prerequisite to the degree for which it has been submitted. It is to be understood that by this approval the undersigned does not necessarily endorse or approve any statement made, opinions expressed, or conclusions drawn therein, but approves the thesis only for the purpose for which it is submitted.

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