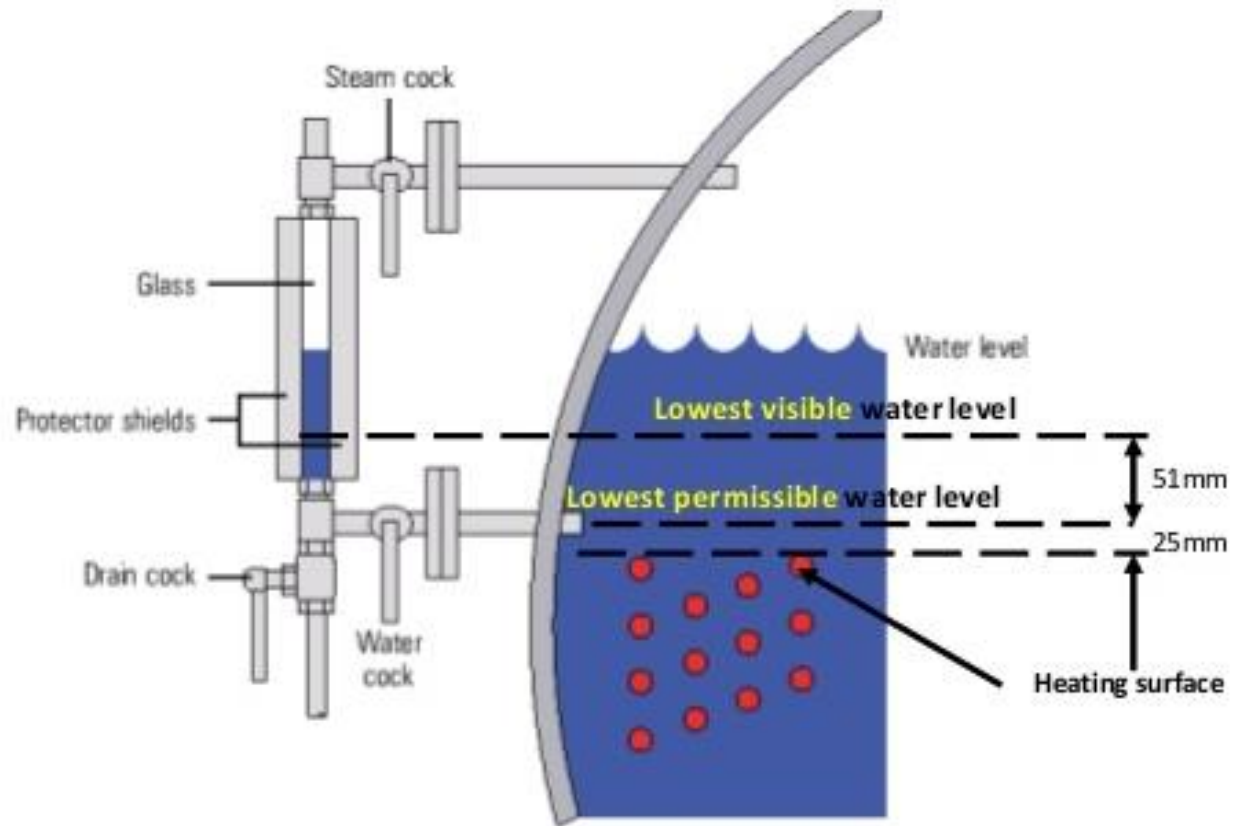


Diamond Power Television Camera

Application to Power Plant Boiler Monitoring

George Lemaster

Conventional Sight Glass Water Level Gauge



[water level gauge boiler pinterest - Bing images](#)

Steam in glass tube makes it difficult to read water level.

Misreading too low water level can be a catastrophic!



At least 16 dead, as many as 100 injured after boiler explosion at Indian power plant, South Asia News & Top Stories - The Straits Times

Nov. 17, 1959

J. CARDNO
LIQUID LEVEL GAUGE

2,912,860

Filed July 13, 1956

2 Sheets-Sheet 1

2,912,860

LIQUID LEVEL GAUGE

John Cardno, Lancaster, Ohio, assignor to Diamond Power
Specialty Corporation, a corporation of Ohio

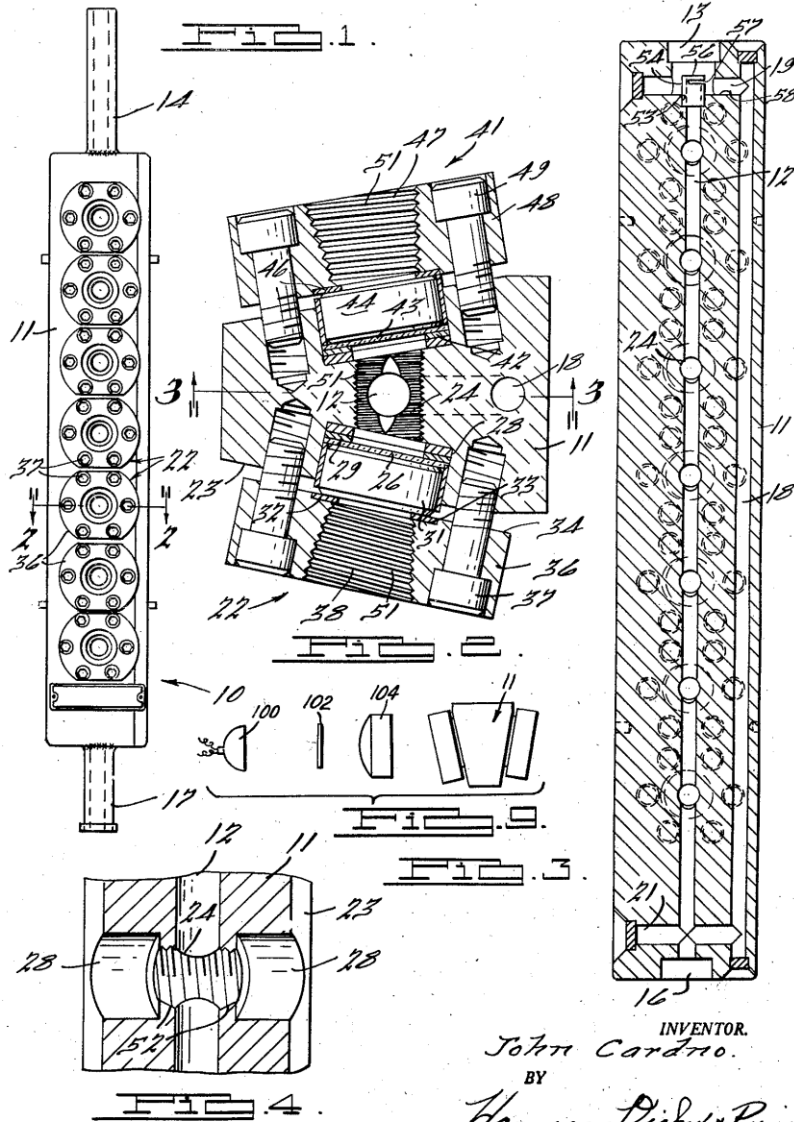
Application July 13, 1956, Serial No. 597,688

Based on 1930's British patents

Blackburn Bi-Color water gauge
Patents 2,024,815
2,115,899

Makes it very unlikely
a gauge column of steam would
be mistaken for a gauge column
of water.

Principal is water refracts light
but steam has relatively low
refractive index.



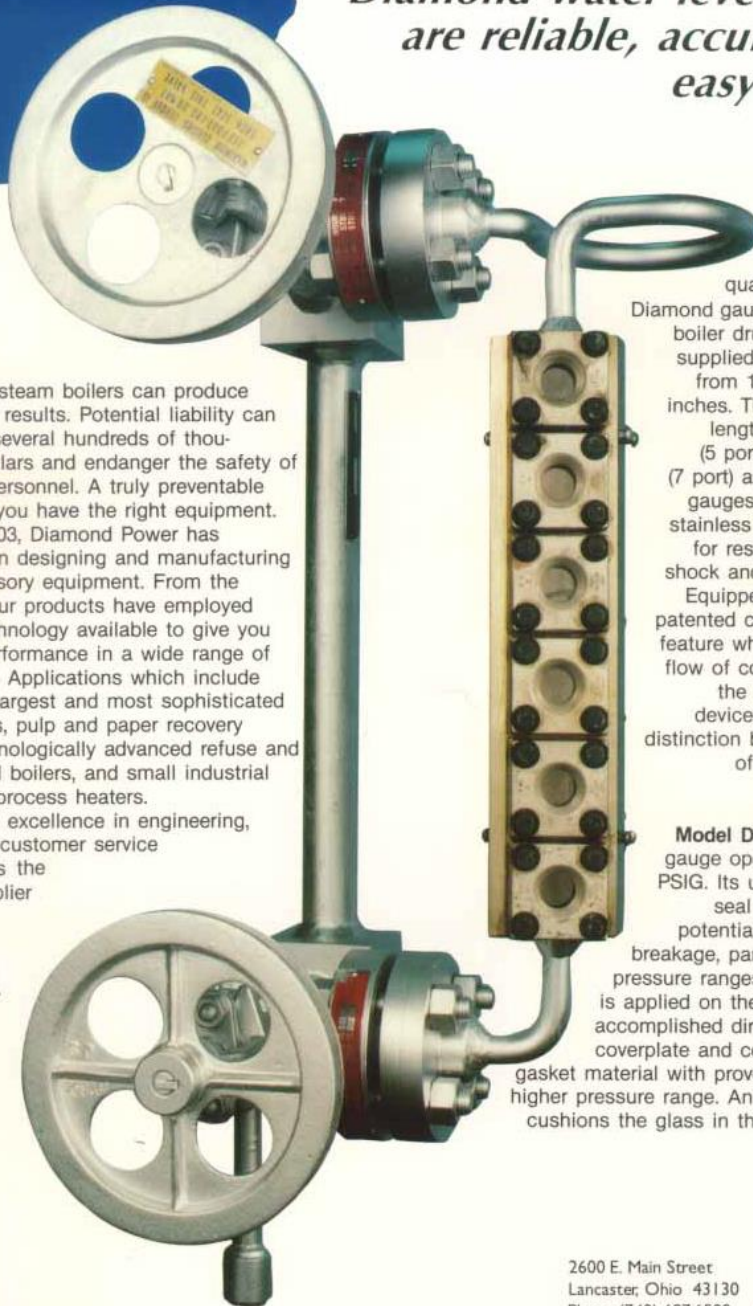
INVENTOR.
John Cardno.
BY
Harness, Dickey & Paine
ATTORNEYS.

*Diamond water level gauges
are reliable, accurate and
easy to read*

Dry-firing in steam boilers can produce catastrophic results. Potential liability can easily cost several hundreds of thousands of dollars and endanger the safety of your plant personnel. A truly preventable situation, if you have the right equipment.

Since 1903, Diamond Power has specialized in designing and manufacturing boiler accessory equipment. From the beginning, our products have employed the best technology available to give you optimum performance in a wide range of applications. Applications which include the world's largest and most sophisticated utility boilers, pulp and paper recovery boilers, technologically advanced refuse and fluidized bed boilers, and small industrial boilers and process heaters.

Diamond excellence in engineering, quality, and customer service has made us the leading supplier of boiler accessory equipment in the world.



Setting industry standards for quality and reliability, Diamond gauges for measuring boiler drum water level are supplied for vision lengths from 12 3/8 inches to 69 inches. The standard vision lengths include 12 3/8" (5 port), 15" (6 port), 18" (7 port) and 21" (8 port). All gauges are supplied with stainless steel centerplates for resistance to thermal shock and stress corrosion. Equipped with Diamond's patented condensate bypass feature which minimizes the flow of condensate through the center bore, these devices achieve superior distinction between the levels of water and steam.

The DURA-PORT Model DP-3000 water level gauge operates up to 3,000 PSIG. Its unique gasket and seal design minimizes potential leakage or glass breakage, particularly in higher pressure ranges. No bolting load is applied on the glass. Sealing is accomplished directly between the coverplate and centerplate using a gasket material with proven success in the higher pressure range. An additional gasket cushions the glass in the coverplate seat.

The Diamond® Series II – Ported Level Gauge (Bi-Color) is a **3000 psi** ported gauge that produces a red/green image to indicate the water level in a high-pressure steam drum.

Light projected through steam produces a red image.

Light projected through water is refracted (bent) and produces a green image.

7 port gauge is
18 inches high

8 port gauge is
21 inches high

<https://www.shopcross.com/sites/default/files/data-sheets/Diamond%20Power-Series%20II-Bi-Color-Gage.pdf>

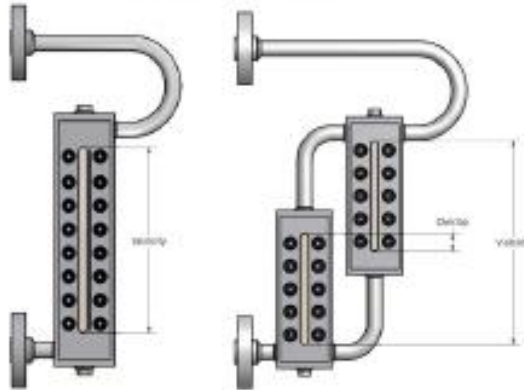
2600 E. Main Street
Lancaster, Ohio 43130
Phone (740) 687-6500



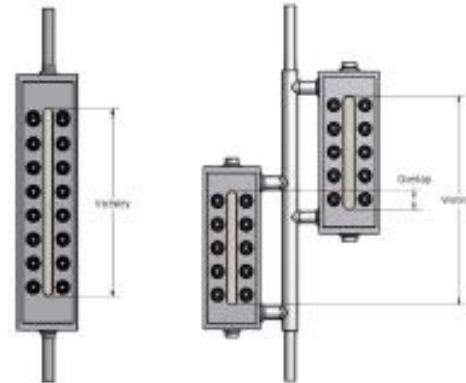
Connections

Standard connections are 0.75 in. (19 mm) pipe nipple or flanged (optional). Custom sizes and configurations are available upon request.

Flange Connection



Pipe Nipple Connection



Babcock & Wilcox
20 South Van Buren Avenue
Barberton, Ohio, U.S.A. 44203
Phone: +1 330.753.4511

www.babcock.com     

The information contained herein is provided for general information purposes only and is not intended nor to be construed as a warranty, an offer, or any representation of contractual or other legal responsibility.

Diamond Power is a trademark of The Babcock & Wilcox Company.
GRAPH-LOCK is a trademark of Garlock Sealing Technologies LLC.

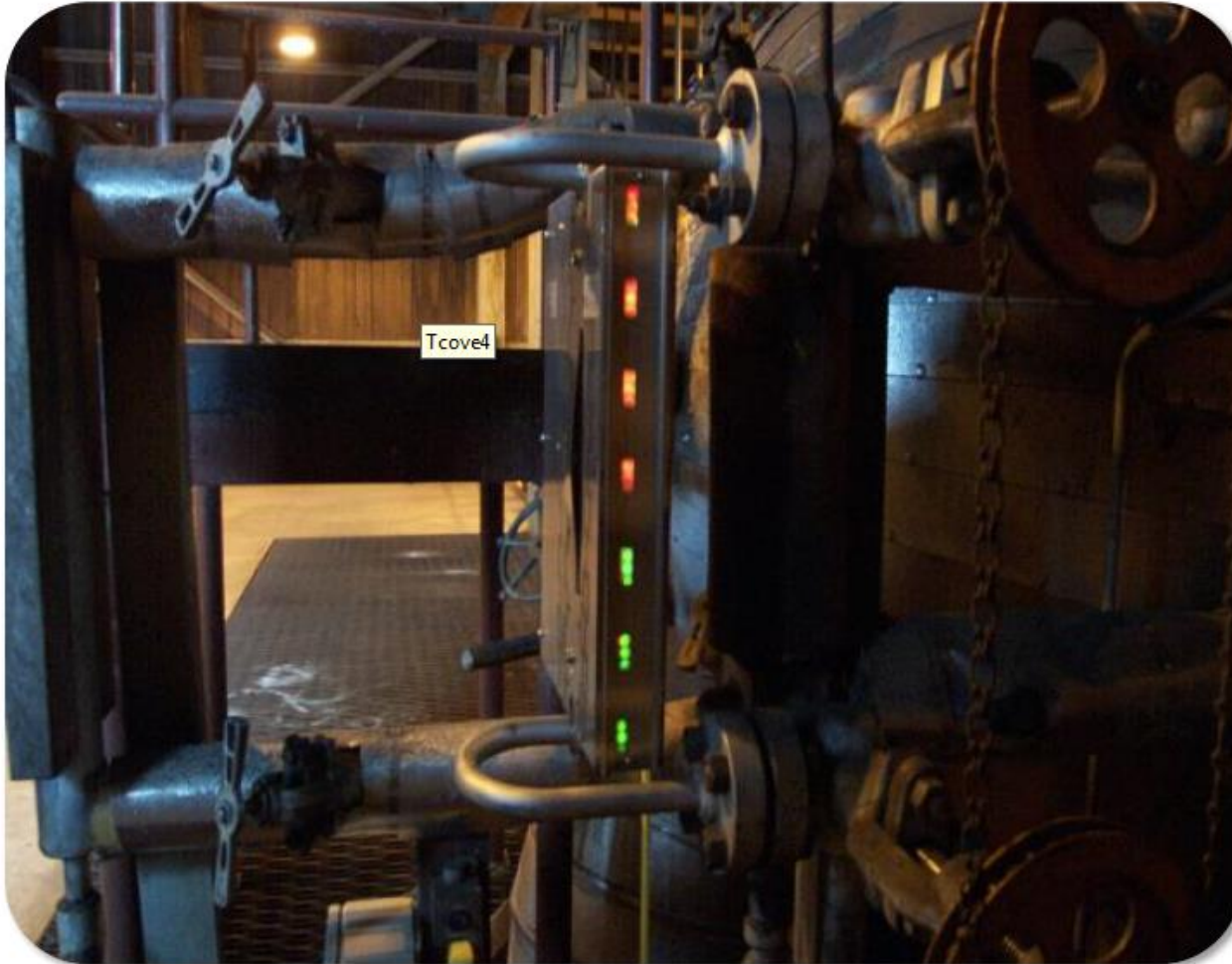


ENERGY | ENVIRONMENTAL

Established in 1867, Babcock & Wilcox is a global leader in advanced energy and environmental technologies and services for the power, industrial and renewable markets, with operations, subsidiaries and joint ventures worldwide.

For more information or to contact us, visit our website at www.babcock.com.

Diamond[®] Series II LED Illuminator



<http://boiler-wrba.org/2016Presentations/2>
BoilerCameraAndSiteGlassSystems.pdf

http://www.earlytelevision.org/diamond_camera.html

Note from Don Stephenson, a design engineer at Diamond Power, copied from the ETF Website:

The monitor you have shown was intended to look at a water gauge on the boiler. The aspect ratio was 4:3 but the whole screen was not needed for looking at a gauge that was mounted in the up position.

The gauge is about 6 inches wide and close to 2 foot tall.

The vertical scan really was rotated by 90 degrees in both camera and monitor so the horizontal was scanning up and down instead of across as we are familiar with in most TV systems. The metal plate on the front covered a round picture tube, if I remember correctly, and the plate was cut to show the part of the image needed in the control room. **Water gauge viewing was the first application for the camera.**

2,573,006

LIQUID LEVEL TELEGAUGE

James A. Good, Grosse Pointe, Mich., assignor to
Diamond Power Specialty Corporation, Detroit,
Mich., a corporation of Michigan

Application May 23, 1947, Serial No. 749,964

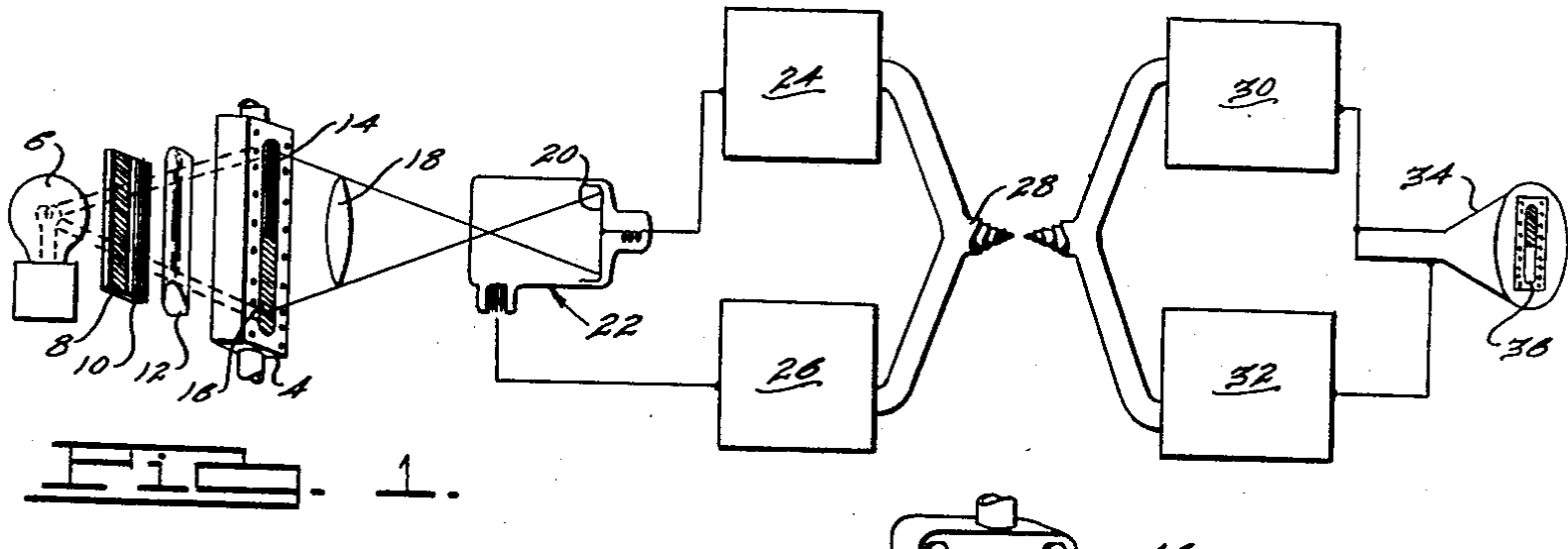
Oct. 30, 1951

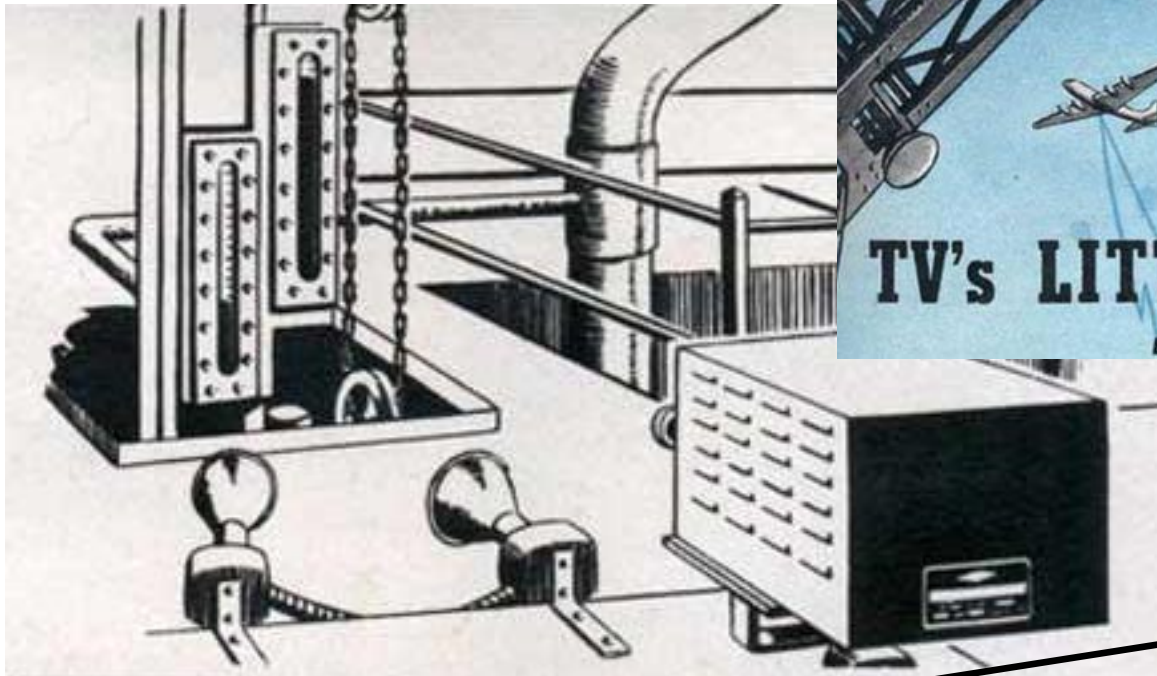
J. A. GOOD

2,573,006

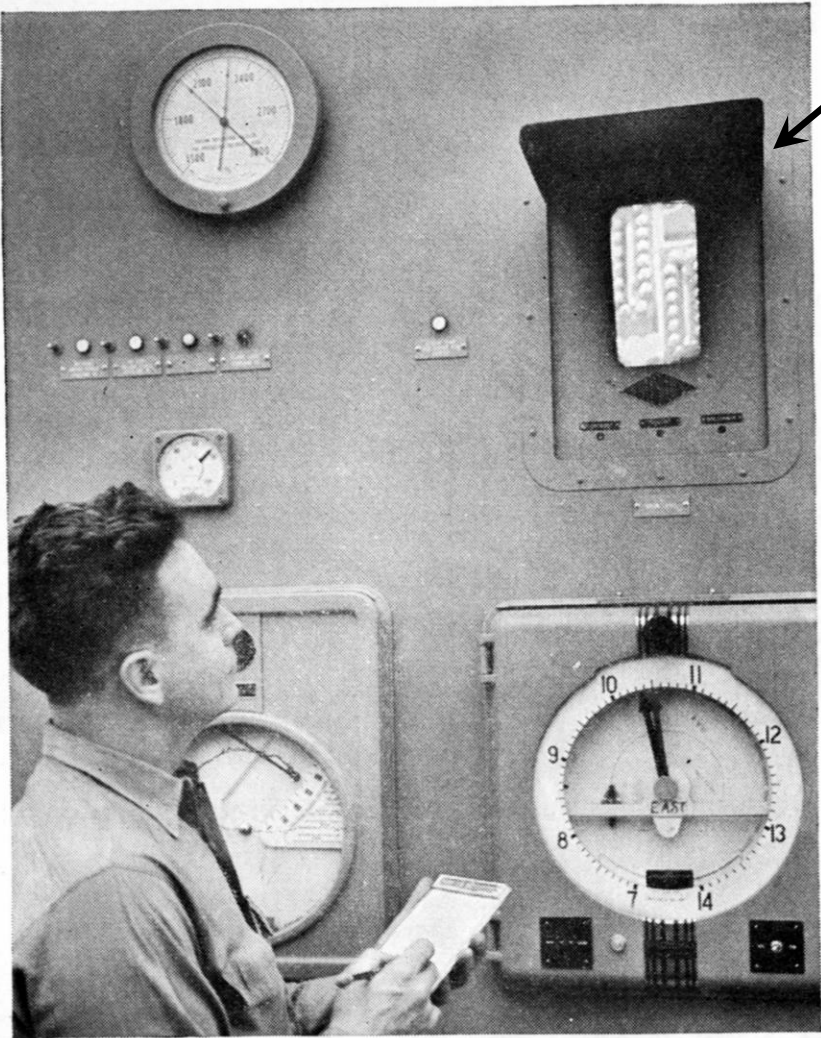
LIQUID LEVEL TELEGAUGE

Filed May 23, 1947





Note image of two
Stacked Water level
Gauges on the
Diamond Power
CRT monitor



Diamond Power
CRT monitors



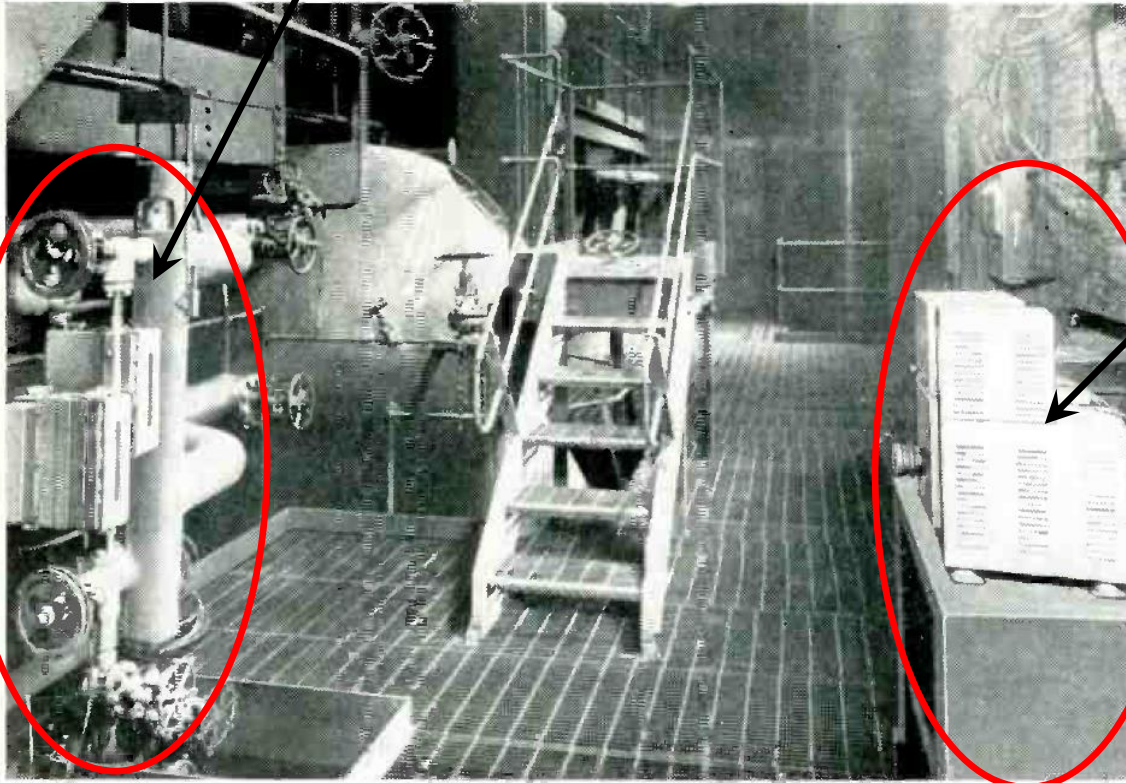
Courtesy of Commonwealth Edison Company

A Diamond Power television system monitors water levels inside a boiler at a power station.

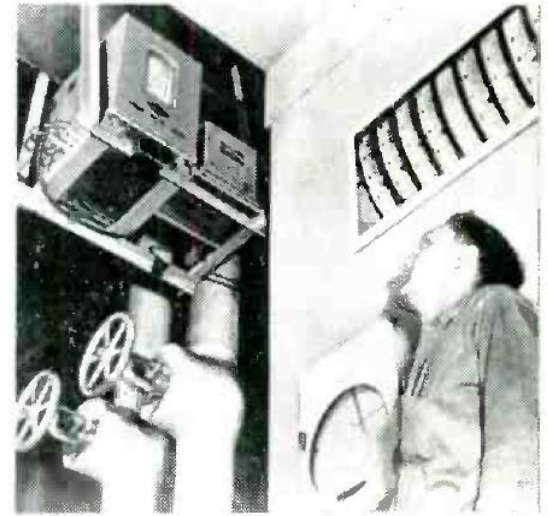
Probably the "oldest" installations in continuous service are those of the four Utiliscopes which the New York Edison Company uses to check on the water level in some of its five-story steam boilers. For four years now, two or more of these little TV eyes have been at work 24 hours a day watching the gauges which indicate the water level in drums at the top of the boilers. This information is relayed to the main control panels on the ground floor.

A pressure of 1400 pounds to the square inch, and a temperature of 900 degrees require special mica-coated glass one inch thick—and even this blows out from time to time—so that watching these gauges can be dangerous.

Water Level Gauge



Camera



Camera at right views level of liquids in two tubes at left in this industrial application of the television system

Operator sees liquid levels on remote monitor screen

'Closed Circuit Industrial Television'
Robert W. Sanders
Capehart-Farnsworth Corp.
Ft. Wayne, Indiana

From:
Electronics Magazine
July, 1950, page 88

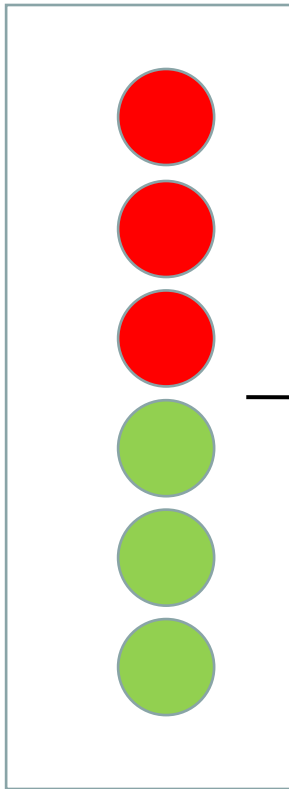


**Discussion in patent 2,578,006 'Liquid Level Telegauge'
Application May, 1947 by James Good, Diamond Power
Specialty Corp.**

**Image Dissector tube chosen because it could be made
Red sensitive and provide good discrimination between
RED and GREEN indicators on a Blackburn Water Gauge.**

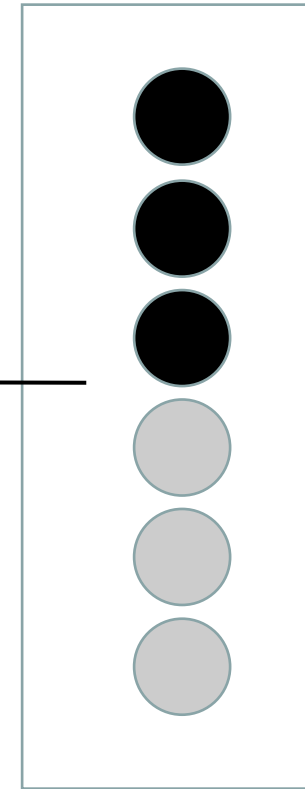
**Iconoscope was tried but could not distinguish between
the red and green indicators of the bi-color water gauge.**

**'..Ordinary television apparatus will not present an image at
the receiving station which permits distinguishing the red
and green sections from one another'.**



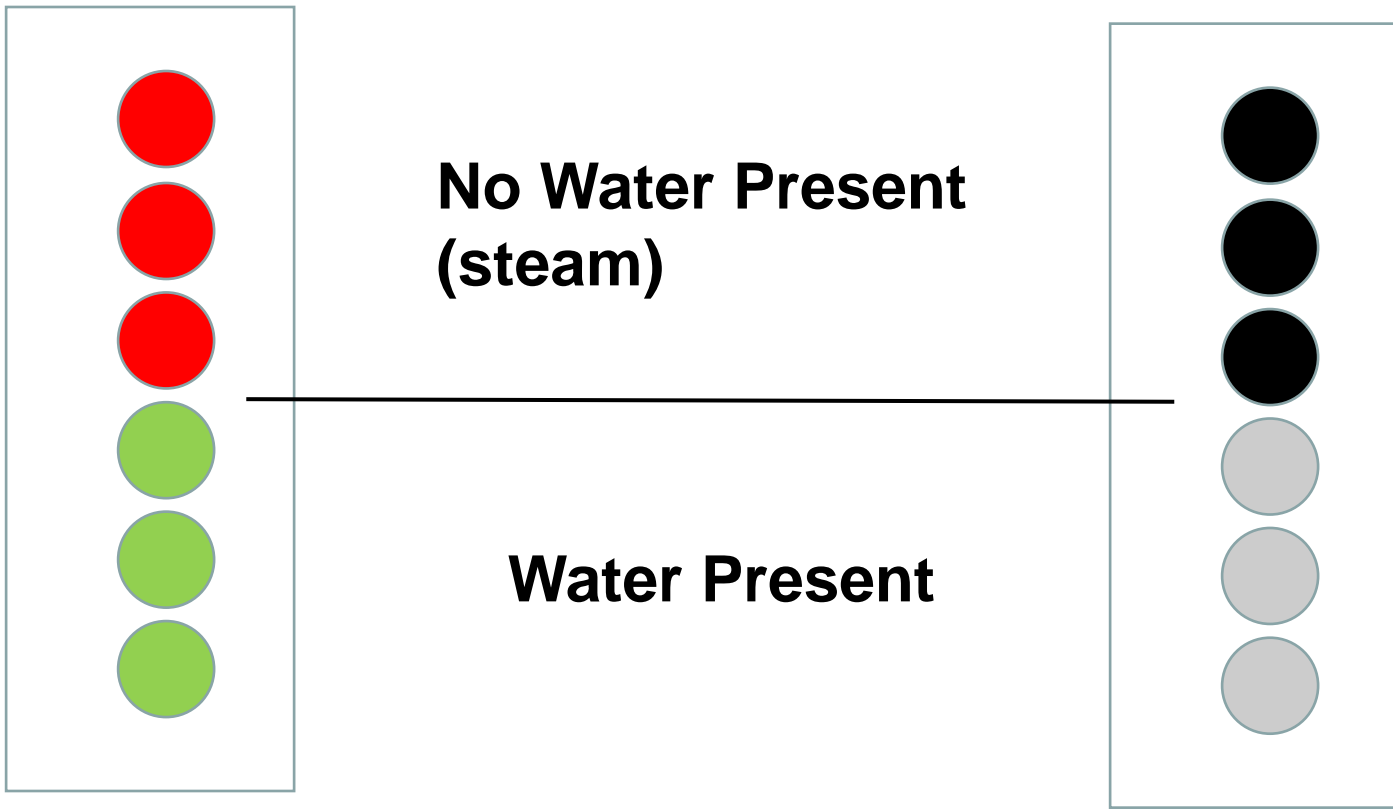
**No Water Present
(steam)**

Water Present



**Color Display at
Water Level Gauge**

**B&W Display at
CRT Monitor**



**No Water Present
(steam)**

Water Present

**Color Display at
Water Level Gauge**

**B&W Display at
CRT Monitor**

**Image Dissector is most
sensitive to RED so video
is High level for red,
Low level for Green**

**Inverted Video Signal
on CRT so Green (low
Video) appears as 'white'**

