this COLOR
TV CAMERA
for about $400
Hurt only two channels of video, this camera
produces color pictures. Any amateur or
by Gary Davis
ACTUAL TV SCREEN PHOTOS OF
THIS CAMERA IN OPERATION

BASED ON LANDS' COLOR THEORY, AND USING
TWO VIDICON TUBES, THIS CAMERA WAS
DESIGNED AND DEVELOPED BY GARY DAVIS.
IT WAS FEATURED IN RADIO-ELECTRONICS
MAGAZINE, AND IS THE ONLY KNOWN LIVE
COLOR CAMERA CONSTRUCTION
ARTICLE.
A 2 TUBE, 12 TRANSISTOR
COLOR TV CAMERA (1975)

CYAN CAMERA PREAMP 4 TRANSISTORS
RED CAMERA PREAMP 4 TRANSISTORS
CYAN AMPLIFIER IN MONITOR 1 TRANSISTOR
RED AMPLIFIER IN MONITOR 1 TRANSISTOR
SYNC CLIPPER IN MONITOR 2 TRANSISTORS
Based on Land's color theory, and using two YISC tubes, this Camera was designed and developed by Gary Davis. It was featured in Radio-Electronics Magazine, and is the only known live color camera construction article.
operating position and said boundaries being sufficiently wide to substantially prevent image light to any point of the image-receiving area from simultaneously passing through adjacent filter segments of different color.

PETER C. GOLDMARK.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,173,476</td>
<td>Goldmark</td>
<td>Sept. 19, 1939</td>
</tr>
<tr>
<td>2,059,222</td>
<td>Fessenden</td>
<td>Nov. 3, 1936</td>
</tr>
</tbody>
</table>
Fig. 3.
Nov. 3, 1936.  R. A. FESSENDEN  2,059,221

TELEVISION SYSTEM

Original Filed Aug. 21, 1922  2 Sheets-Sheet 1
Early Television Developments:

- **Rosing**: took out patent for hybrid mechanical/electronic television system in 1907; by 1911 could transmit “luminous bands.”

- **Swinton**: described electronic television system in 1908; expanded on concept in 1911 lecture

- **Jenkins**: disclosed “prismatic rings” in 1920; wirephoto transmissions in 1922; claimed to have transmitted silhouette images in June 1923; first public demo—1925

- **Baird**: began work in early 1923; first demo—Jan. 1924

- **Zworykin**: suggested television project to Westinghouse’s director of research in spring of 1923.

- **Alexanderson**: began thinking about television in mid-1924; demo for GE officials—January of 1925

- **Ives**: started experimentation at AT&T in 1925; first demo—1927
A Forgotten Television Visionary

James E. O’Neal
Technology Editor

May 2
POLOROID OF FIRST APOLLO 10 COLOR TV IMAGE – FEB. 17, 1969
APOLLO 10 CAMERA & COLOR WHEEL
APOLLO 10 COLOR CAMERA
COMPARISONS

After and Before Scan Conversion

- Parkes: Converted video at Houston
  Converted picture.
  Subcarrier of TV at Houston.

- Goldstone: Slow scan TV monitor at Goldstone
  Slow scan picture.
  Mounted Polaroid, taken at Goldstone.
  (Photo with thanks to Bill.)

GET 116:41:48
COMPARISONS

After and Before Scan Conversion

Goldstone
- scan converted video at Houston
- converted picture
- rear of TV at Houston

Honeysuckle Creek
- slow scan TV monitor at Honeysuckle
- slow scan picture
- handheld 35mm SLR photo, taken at Honeysuckle Creek (4XKT-0151)

GCT 10925:18
Armstrong installing the LEC on the secondary strut.
COMPARISONS

After and Before Scan Conversion

Parkeas
-- scan converted video at Houston
Scan converted picture.
Scope of TV at Houston.

Parkeas
-- slow scan TV monitor at Sydney Video
Slow scan picture.
4 x 5" Polaroid taken at Sydney Video.

GET '109:52:40
Armstrong (foreground) and Aldrin unveil the plaque.
LM 100 FT. LUNAR SURFACE CABLE

Figure 4.6. La Cable
## LUNAR SURFACE TEMP. AND LIGHT ENVIRONMENT

### EVA TEMPERATURE:

<table>
<thead>
<tr>
<th>Environment</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUNAR SURFACE</td>
<td>300 DEG. F</td>
</tr>
<tr>
<td>DEEP SHADE</td>
<td>-250 DEG. F</td>
</tr>
<tr>
<td>*LUNAR NIGHT</td>
<td>-250 DEG. F</td>
</tr>
</tbody>
</table>

*PRE-NOTIFICATION REQUIRED FOR NIGHT MISSIONS*

### LUNAR EVA LIGHT LEVELS:

<table>
<thead>
<tr>
<th>Environment</th>
<th>Light Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUNAR DAY</td>
<td>12,600 FT. LAMBERTS</td>
</tr>
<tr>
<td>SHADE</td>
<td>5 – 0.07 FT. LAMBERTS</td>
</tr>
<tr>
<td>LUNAR NIGHT</td>
<td>2 – 0.01 FT. LAMBERT</td>
</tr>
</tbody>
</table>
CAMERA INTERNAL VIEW
CAMERA INPUT POWER CONTACTS NIOBIUM DISELINIDE (NSB2)
<table>
<thead>
<tr>
<th>APOLLO LUNAR CAMERA</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEIGHT</td>
</tr>
<tr>
<td>POWER</td>
</tr>
<tr>
<td>VIDEO FORMAT</td>
</tr>
<tr>
<td>TV SENSOR</td>
</tr>
<tr>
<td>HIGH VOLTAGE</td>
</tr>
<tr>
<td>THERMAL CONTROL</td>
</tr>
<tr>
<td>CAMERA FUNCTIONS</td>
</tr>
<tr>
<td>ALC RESPONSE</td>
</tr>
<tr>
<td>GAMMA</td>
</tr>
<tr>
<td>MISSION STATUS</td>
</tr>
<tr>
<td>APOLLO TV FORMAT</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td><strong>NORMAL MODE:</strong></td>
</tr>
<tr>
<td>10 Frames/Sec.</td>
</tr>
<tr>
<td>320 Scan Lines</td>
</tr>
<tr>
<td><strong>HI RESOL. MODE:</strong></td>
</tr>
<tr>
<td>0.625 Frames/Sec.</td>
</tr>
<tr>
<td>1280 Scan Lines</td>
</tr>
<tr>
<td>Non-Interlaced</td>
</tr>
<tr>
<td>500 KHZ BW</td>
</tr>
<tr>
<td>Conversion Req.</td>
</tr>
</tbody>
</table>
CAMERA COMPONENTS

80% OF THE TOTAL COMPONENTS WERE CUSTOM IC’S

- TOTAL OF 28 CUSTOM IC’S DESIGNED FOR TV CAMERA
- THE 12 MOST DIFFICULT MADE AT WESTINGHOUSE BALTIMORE
- THE BALANCE MADE BY 4 COMPANIES, EACH DESIGNED 4 IC’S
- TYPES OF IC’S INCLUDED:
  - LSIC, SSIC, SMALL MONOLITHIC, LSHYBRID
SEC VIDICON TV TUBE

Lens

Photocathode

Anode

Image Section

+V_m

Hybrid Gun

Target Assembly

Video Signal (I_h)

-2 kV to -8 kV

+V_T

Target Voltage
WHY WESTINGHOUSE

DESIGNED TV FOR MILITARY HIGH SPEED AIRCRAFT, SHIPS, SUBMARINES, TANKS, ARMY FIELD USE

1. MILITARY CAMERA REQUIREMENTS:
   SMALL COMPACT PACKAGE - NO EXTERNAL CONTROLS

2. MEETS EXTENSIVE MILITARY SPECIFICATIONS
   MUST OPERATE IN HARSH ENVIRONMENTAL CONDITIONS

3. INTEGRATED CIRCUIT DEVELOPMENT IN-HOUSE FACILITY
   REQUIRED ADVANCED LSIC BEYOND EXISTING STATE OF THE ART

4. ARMY DEVELOPMENT SEC LOW LIGHT LEVEL TV CAMERA TUBE
APOLLO TV CAMERAS

Apollo, Skylab and Apollo Soyuz Test Project

Neil Armstrong To Aleksey Leonov

Stan Lebar

Westinghouse Electric Company, Retired
Program Manager
Apollo TV Camera Systems

2002 Early Television Convention
KEY TO SUCCESS FOR THE NEXT GENERATION OF ENGINEERS

Erfolg durch Mühe, Arbeit und Zielstrebigkeit, dazu auch Glück, der zündende Funke oft im entscheidenden Augenblick.

---Walter Bruch
The Life of Dr. Walter Bruch: A Biography
Mittweida, Saxony 2008

Walter Bruch
Eines Menschen Leben
THE OLD AND THE NEW GENERATION

Ruth and Jan Bruch.
Recognition and Hall of Fame, described as one of the greatest inventors of the 20th century, 1977.

Werner von Siemens Ring awarded to Walter Bruch and Wernher von Braun.
In 1975, example of great success after formidable political and financial opposition.
Walter Bruch after receiving the most prestigious award of Germany, 1968

Reinhard, Ruth, and Walter Bruch.
In 1967, German color television inauguration using Walter Bruch’s PAL system.
In 1963, first demonstration and historic gathering of the Bruch System at his laboratory in Hanover and first field tests.
In 1962, he filed his first patent for the later renamed PAL Color Television System.
Dr. Walter Bruch in his Laboratory, 1962
New beginning in Hanover after the second world war: Development in 1950/51 of the first German television set.
During 1942/43 television system and recordings were applied in monitoring the rocket launches at Peenemünde.
In 1937, he demonstrated 375 line Television at the Paris International Exhibition
In 1936, he made one of the biggest accomplishments in television history by recording an athletic event at the Hitler Olympic Games with his ionoscope camera.
Walter Bruch started his television career in the early 1930’s at the research Laboratories of Dénes von Mihaly, where he met his future wife (my mother).
Walter Bruch’s Student Laboratory in Horse Stable in Mittweida, Saxony
GENESIS OF A REMARKABLE ENGINEER

“Walter Bruch” in Mitteweida (1929).
Der Bruch
Ein deutscher Fernseh-Pionier
Receiver in operation
Receiver in operation
Receiver in operation
Receiver in operation
Receiver in operation
Receiver in operation (horz. deflection UX-210)
Receiver in operation (blue glow of mercury rectifiers)
Receiver as it appears today
The IRE papers showed the above characteristic IF graphs for the picture and sound receivers. While the reproduction sound receiver perfectly matched the 50kHz width and 8000 gain shown on the right, the picture receiver IF’s showed only about 200 gain instead of the stated 7000. It was noticed that the partial schematics showed a damping resistor on the input of each picture IF, yet there were no signs these resistors were ever used on this chassis. This made no sense since the bandwidth was correct.
Tetrode’s have a unique property that when the screen grid is operated at a higher voltage than the plate, they enter an unstable region of negative resistance caused by secondary emissions. This is what allows the Dynatron Oscillator to work. Later versions of the tetrode (224A) purposely had the plates coated with carbon to reduce secondary emissions and do not work for Dynatron Oscillators.
Three types of the UY-227 were available over time denoted by the different plate structures. Any of these types work fine in amplifier applications, but only the early design on the far right with the short plate structure works for the Local Oscillators at up to 80MHz.
Design Issues

Different types of the UY-227 were available over time denoted by the different plate structures. Any of these types work fine in amplifier applications, but only the early design on the far right with the short plate structure works for the Local Oscillators at up to 80MHz.
Picture Receiver undergoing Conservation
First Light
Kinescope

TUBE NO. 308  TYPE NO. C T30
FOCUS  VG  SCREEN
Eff  2.5  Esa  150
Eps  900  Epl  4600
Complete Kinescope Chassis
Vertical Deflection Chassis
Deflection Assembly
Kinescope Chassis
Complete Sound Receiver
Reproduction Wiring Harness
Terminal Boards Under Construction
Interesting Facts

- Tubes require 54 Amps at 2.5 VAC or 135W of power for filaments alone.

- Entire set runs off a single 1000V 225ma supply. This high voltage was only required by the horizontal deflection circuitry. All other voltages are derived using 100W and 50W resistors as series droppers. Because of this, the mains voltage is extremely critical to correct operation, so a multi-tapped primary transformer is used that can select the mains voltage in 5V steps.
Kinescope/Deflection Chassis’
Receiver Field Strength Tests

Fig. 4
Transmitter Sync Generator
Transmitter Film Scanner
Transmitter Composite Picture Signal

- (b) Section of picture signal (expanded)
- (c) Horizontal synchronizing impulses
- (d) Vertical synchronizing and return line elimination impulse
- (e) Complete signal (b) + (c) + (d)

Fig. 2
Background

- These sets had many advanced features:
  - Zworykin’s new hard vacuum 9” kinescope
  - Composite video signal with embedded syncs and blanking pulses
  - 120 line / 24fps scan rate
  - Sawtooth scanning
  - Fully magnetic deflection

- 4 - 6 sets were constructed (recollection of Robert Morris, Chief Development Engineer, who had one in his home) (also from Proceedings of the IRE, G.L. Beers “Description of Experimental Television Receivers” which states “Several television receivers were constructed for use in a...”
Sentinel
Model No. 816C
Watts 375

VOLTAGE 110-120 Vol. 60 Cycle Alternating Current (A.C.) only.

This apparatus contains a number of United States patents licensed by Radio Corporation of America. Patents numbers supplied upon request.

HIGH VOLTAGE

THE BACK COVER IS EQUIPED WITH AN INTRLOCK TO PREVENT DANGEROUS ELECTRICAL SHOCK. DO NOT TAMPER WITH INTR-LOCK OR ATTEMPT TO OPERATE SET WITHOUT BACK SCREWED TO CABINET WITH ALL OF ITS MOUNTING SCREWS.

MADE IN U.S.A.

SERIAL NUMBER T 50879
November 15th 1949

Fred Television Corp
Ashory Park, New Jersey

Gentlemen:

Now that TRADIOVISION has become such an important feature of our business, we find it a pleasure to be able to advise you that all of the claims and representations that you originally made regarding TRADIOVISION's success as a business builder were not exaggerated.

Since the time of the TRADIOVISION installation, we have become firmly convinced that the home type television receiver, regardless of its picture size, is here to stay. Please this to admit we are happy to advise you that we feel that we took a progressive step in trading-in our DuMont 20" receiver, for which we paid $2500.00, to the purchase of your full TRADIOVISION model.

The management staff here at Jack Dempsey's Restaurant have always felt their main responsibility is providing the public with the newest and the best, in order to retain our high position in our field.

We believe that our decision to install TRADIOVISION is certainly in line with this policy. Therefore, may we make our enthusiasm for TRADIOVISION known to anyone who may now be skeptical over the reality of television with theatre-size images and its effectiveness as a business stimulant.

Kindest personal regards,

Jack Dempsey

Jack Dempsey's Restaurant
YOU'LL BE AMAZED WHEN YOU
DISCOVER HOW A FRESH DRINK
ADDS TO THE PLEASURE
OF OBSERVING

tradioVision
THEATRE-SIZE TELEVISION

Manufactured by TRAD TELEVISION CORP., Asbury Park, N. J.
Come in and enjoy your favorite TELEVISION programs on...

tradioVision
LIFE-SIZE SCREEN, CLEARER by far!

YOU'LL BE AMAZED WHEN YOU DISCOVER HOW A FRESH DRINK ADDS TO THE PLEASURE OF OBSERVING tradioVision.

[Image of people sitting in a room]

[Letter]

[Image of a certificate]
This device was designed to enable television to be used in areas where there were no TV stations. It acted as a receiver, transmitting sound through the speaker to be heard in the room. These units were used primarily in bars and hotels.

The device was used in the late 40s and early 50s, especially in hotels and bars where television sets were not available. The IF amplifier tab was removed, and the device was plugged in to receive the broadcast signal.
National TV-7M

National was another manufacturer of amateur radio equipment. In the late 40s they decided to enter the TV business. This set is built in a cabinet that the crew they used for their farm radio operations. It has a meter to measure signal strength.

Screen Size: 7 in.
Type: Manual
Cabinet: Wood
Channels: Not Reported