

Page **1** of **22** Pages

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Visual Concepts

Script

1

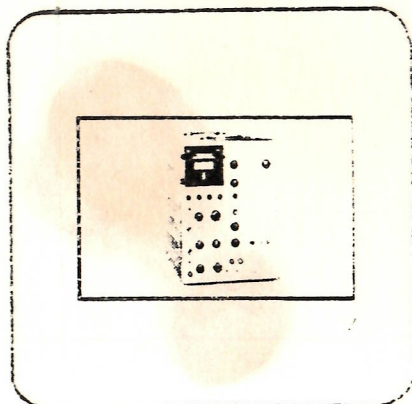


LEAVE ON SCREEN

E.I.D COVER

On January 18th, Tektronix introduced the most advanced oscilloscope in the world today, the 7104 oscilloscope. A One Gigahertz real time oscilloscope with a vertical plug-in sensitivity of 10 millivolts per division and a horizontal sweep speed of 200 picoseconds per division.

3



In 1962 Tektronix introduced the 519. This 1000 megahertz oscilloscope offered 10 volts vertical sensitivity and a sweep speed of 2 nanoseconds per division.

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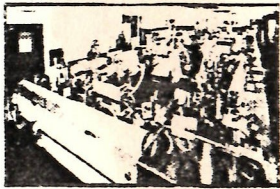
Visual Concepts

Script

519 / 100LB weight.

It had one distinct disadvantage; not really a portable instrument. This fact and its limited vertical sensitivity greatly limited its application.

4

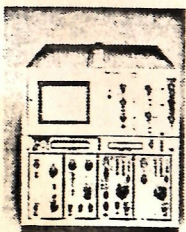


17 years after its introduction the 519 is still widely used particularly in laser technology.

We should not forget its role in the emergence of the world's thermonuclear powers in the early 60's to measure the power of the atom.

This instrument has fulfilled a vital role in high frequency instrumentation needs of the 60's & 70's.

2



Today's needs require a greater versatility and to meet this need Tektronix has introduced the 7104.

To day we are going to look at two important aspects developed here a Tektronix developed the 7104 oscilloscope.

Figure V-2
A multi-image script sheet

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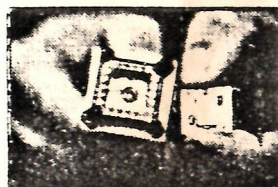
Visual Concepts**Script***Innovation slide*

The key to our success at Tektronix
is innovation. What we will now
look at is two fine examples of
innovation



The first one ^{we} will look at is its
unique C.R.T.

81



And then the thin film hybrid
technology developed at Tektronix for
the 7104

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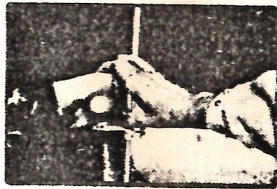
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44



As with all fundamental ideas there must be an inherent understanding of the physical laws of nature.

We see such an example of the physical laws in the development of the micro channel plate. This unique structure is one of the major components of the cathode ray tube used in the T104

The M.C.P. or the micro channel plate is called is

The ~~MCP~~ is an assembled structure of Microscopic conductive glass channels. An electron entering a channel will produce secondary electrons as it strikes the channel walls. This process cascades thru the channel resulting in a multiplication of several hundred thousand times. It is this phenomena which gives the CRT its ^a~~tremendous~~ writing rate. Much in excess

of an C.R.T. today

E.D. on
C.R.T.

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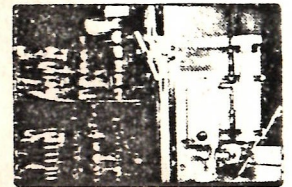
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Visual Concepts**Script***Photo.MULTIPLIER**The principal of electron multiplication is not new. Here we see the principal explained in a text published in 1945.*

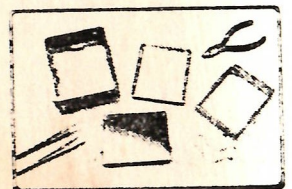
The MCP's are purchased from Galileo Electro optics.
At TEK, they must be stored in special cabinets
that are filled with dry nitrogen to keep out
moisture and other contamination.

46



The entire inspection and assembly process of the
faceplate must be done in a controlled clean room
environment.

47



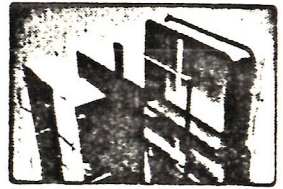
The first step of the assembly process is to
inspect the MCP for cracks, blocked channels, and
hole uniformity.

48



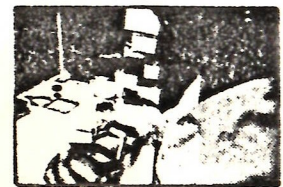
6

The MCP requires a special high tolerance mounting system which will place the plate exactly 3 millimeters from the aluminized phosphor coating.



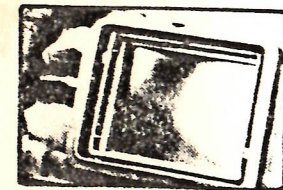
Spacing and mounting are critical since 700 to 1200 volts will be applied across the two surfaces of the plate.

50



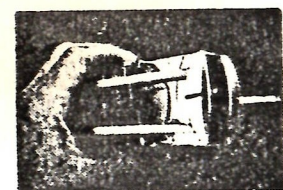
The faceplate assembly is now completed and awaits joining to the CRT gun assembly.

51



Another major technological advancement introduced in the 7104 CRT is the meshless scan expansion lens, sometimes called the M.S.E. lens.

52



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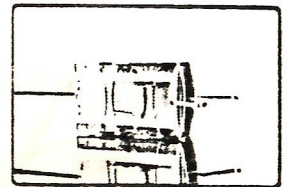
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Starting with a block of stainless steel 4" x 2.5" x 1" and etching parts away, Conrad came up with a basic square shaped box that would expand the beam.

54



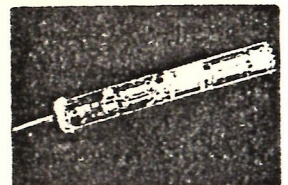
Within six months, the lens was refined to where it would successfully expand an electron beam scan to an 8 x 10 division display with no distortion or increase of spot size. Without a new type expansion lens, the CRT would have to be 7 feet long.

55

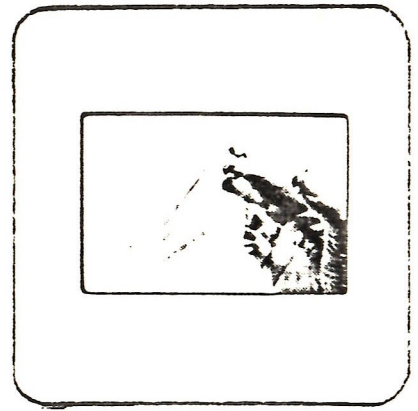


The final major portion of the new CRT is the gun assembly. The 7104 CRT uses similiar processes as other simpler CRT's but is much more complex.

56

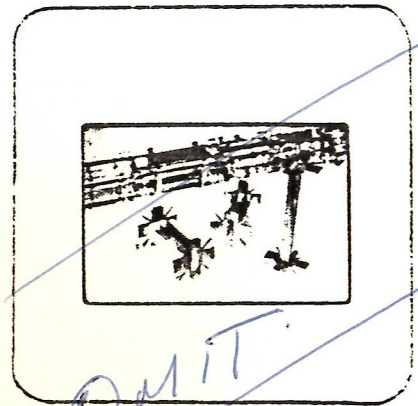


8 Distributed vertical deflection plates have been used in previous high frequency CRT's: First, the 519, more recently, the 7844 and 7904 CRT's. These distributed plates give the 7104 CRT approximately 3 Gigahertz capability and enables the 7104 to offer a 1 Gigahertz system bandwidth.



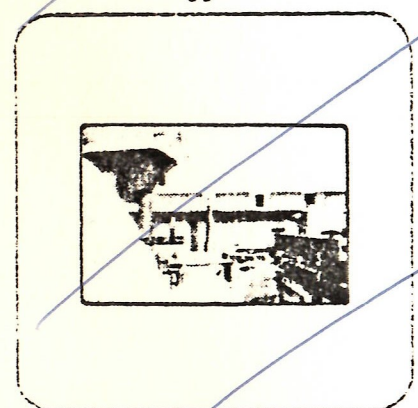
The 7104 takes distributed deflection one step further. For the first time, horizontal plates are also distributed. This allows linear sweep speeds to 200 picoseconds per division and extremely wide horizontal bandwidths for an X-Y measurement capability to 350 MHz.

58



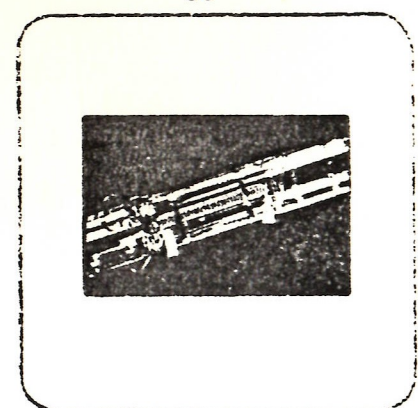
Assembly of the gun is done in a fixture which maintains close tolerances and proper alignment.

59



Four glass rods are then fused to the gun rigidly holding the alignment of the gun structure. Here we get an excellent view of the vertical deflection plates in the rodded gun structure.

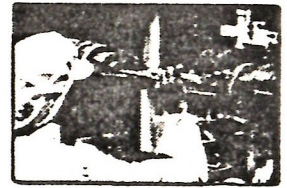
60



61

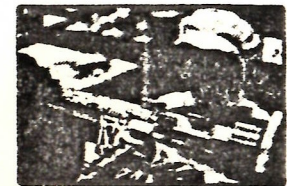
9

The rodded gun structure is put into a lathe where glass envelopes will be sealed around the gun.



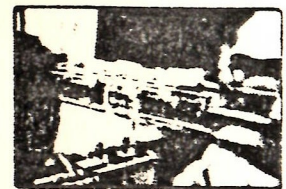
62

The operator applies the heat and controls the rotation to maintain the proper speed.



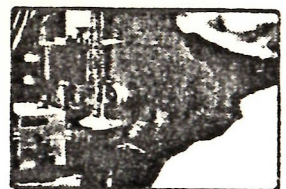
63

And, the glass envelopes are sealed together.



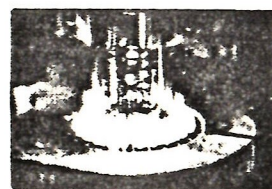
64

Molten glass is then applied to the base of the CRT.



10

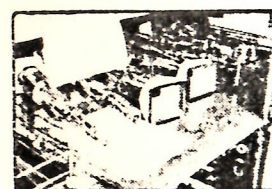
And, the neck pins are sealed off.



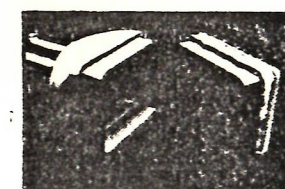
The stem protruding from the base will be used later to evacuate the air from the CRT.



The finished gun assembly waits to be joined with the faceplate containing the micro channel plate.

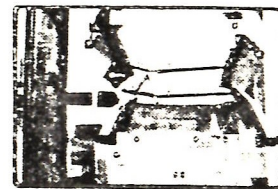


To assemble both halves of the CRT, special metal flanges have to be used because the MCP cannot tolerate temperatures used with glass or ceramic processing. Tektronix has pioneered the development of ceramic CRT's and has also pioneered metal to ceramic and glass bonding.



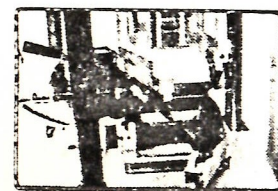
11
To complete the joining process, the upper and lower CRT halves are aligned in this special TEK designed heliarc fixture.

69



The copper plates maintain the critical alignment of the upper and lower flanges and act as heat sinks to protect the MCP.

70



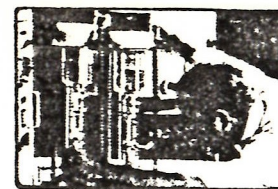
The CRT is then rotated while the heliarc welds the joint.

71



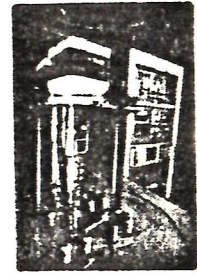
The CRT is now complete and all gases will be evacuated. Here, Stan Prier places a tube on an oil diffusion vacuum pump with a dry nitrogen trap.

72

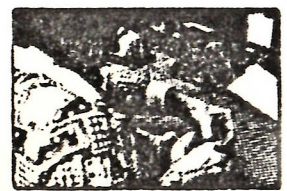


12

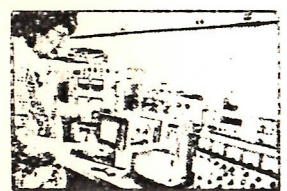
Because of the high moisture content of the MCP, it is necessary to vacuum pump the tube continuously for 24 hours as opposed to only 4 hours for other CRT's.



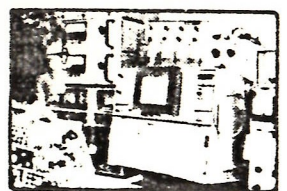
Up to this point, we can only assume a good CRT. Only testing will tell. The tube must first be wired....



And then mounted in a special test fixture.



This test set was designed to support testing of this special, highly complex CRT until a more automated test station can be installed.



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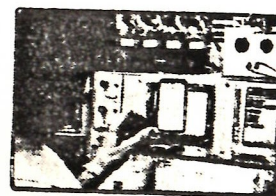
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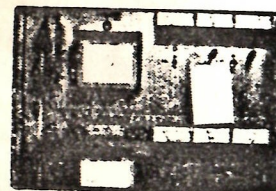
After the CRT is successfully turned on for the first time, it is inspected for any operational defects.

78



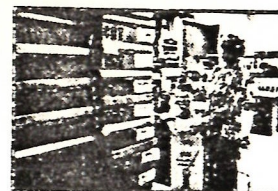
After testing, the CRT's are aged for 24 hours to stabilize the gain on Micro Channel plates.

79



The tubes are then shipped to the 7104 manufacturing area for assembly into the finished product.

80



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E.D FRONT COVER
SHOWING HYBRIDS

The thin film hybrid technology here at Tektronix embraces some of the most sophisticated technology in the world today.

We will look at three major components of our hybrid technology.

Hypcon Connector

First the patented Tektronix Circuit Board Connector called the Hypcon.

SHF III DIE

Next one of our integrated circuits process especially evolved for the 7104 program known as our SHF III process.

155-0176-00
Hybrid

And finally the hybrid assembly techniques.

Hypcon Connector

The hypcon connector achieves two important functions.

First it allows the signal path and its critical parameters to process the signal thru the system in an uninterrupted manner.

Second it allows simple installation or removal of the hybrid device.

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Exploded view of
the hycon system.

Here we see an exploded view of the hycon connector system. It should be noted here that the hycon connector has a V.S.W.R. of better than 1.1 to 1. Considerably better than most of the popular 3 m.m. connectors and a fraction of the cost of such connectors.

DIE device

Here we see our integrated circuits in die form

E.D. on SHF III

Here we see a cross section on the integrated circuit. The base and arsenic doped emitters are both ion implanted for superior control of doping profiles.

Shallow, repeatable junctions are essential for high f_t s, typically about 6 GHz.

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*1/2 dollar and
hybrids*

*The thin film technology at
Tektronix is a combination of
many specialised areas starting
with computer graphics and mapping,
advanced thin film technology,
laser technology, and advanced
assembly techniques*

Figure V-2
A multi image script sheet

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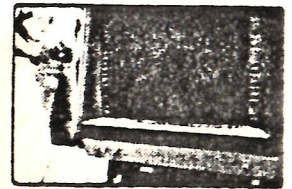
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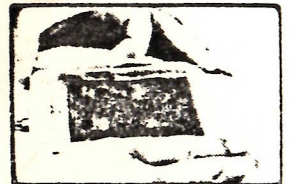
82

The artwork for the IC chip and the substrate is hand drawn and then computerized.



83

Filmwork is then made, and placed over a photoresistive coated plate of ceramic.



84

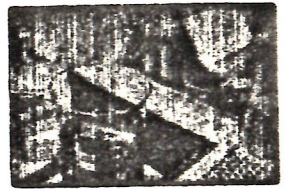
The photo resist is then exposed to light....



18

And the remaining material is then etched away.

85



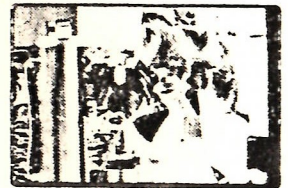
This leaves the desired patterns on the ceramic.
These devices will then be laser scribed into
individual substrates....

86



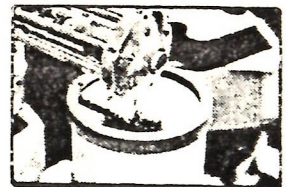
and are ready for the IC die attachment.

87



The IC's are picked up by vacuum.

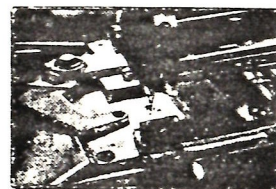
88



19

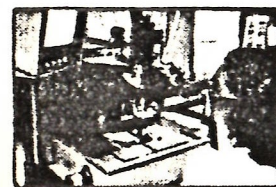
And are attached to the ceramic substrate.

89



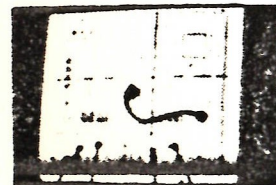
The wire bonding machine automatically forms, places, and welds the wires from the IC to the substrate.

90



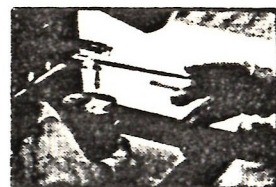
These solid gold wires are extremely fine. They are 1 mil. thick. The operator uses a microscope video system to ensure proper bonding.

91



The wire bonds are then pulled to check proper bonding strength.

92



20

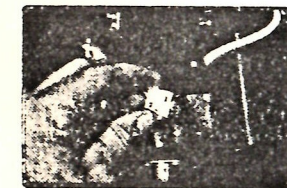
The finished IC hybrid is then laser trimmed by a YAG laser which moves across the hybrid....



and precisely etches away the resistive networks, leaving the proper values on the substrate.



The hybrid is now complete and ready for testing.



This 3260 system first checks the DC operating parameters of the hybrid.



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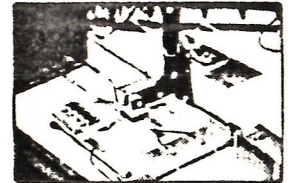
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Because of the high frequency nature of these devices, special fixtures must be used for dynamic testing.



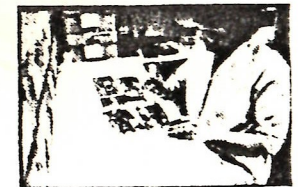
98

They are tested for bandwidth and transient response.



99

The devices are now shipped to the 7104 manufacturing line where they will be built into the many circuit boards....



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Script

TA-29 Crant

7104 trigger
Crant.were they are built into
many crant boards

Jek Slide.

We hope you have enjoyed
this slide presentation of the
7104 Oscilloscope
Thank you