00:11

foreign

00:35

foreign

00:48

me

01:06

okay

01:10

today uh

01:12

i am going to talk about

01:22

today i am going to talk about

01:25

Second part of the second industrial revolution

01:33

first phase first phase of the second

01:35

industrial revolution is between

01:50

01:52

1850 and 1910s .so

01:55

before first world war

01:58

02:06

[Music]

02:08

first phase of the second industrial

02:10

Revolution ends.

02:12

02:14

second phase of the second industrial

02:16

revolution is

02:19

until second world war.,

02:23

so until first world war

02:28

first part of the second industrial,

02:30

Revolution,,,,,

02:32

until second world war second phase of

02:35

the second industrial revolution,,

02:38

when we talk about 1850

02:44

it it roughly

02:48

corresponds to

02:50

the dates when american

02:54

civil war

02:55

ends

02:57

so after american civil war united

03:00

states formed and united states

03:03

development

03:05

with the european development together

03:07

with the germany foundation of the

03:09

germany etc

03:11

second industrial revolution

03:13

started

03:15

and by the time first world war

03:18

happens

03:20

first phase finishes after the

03:23

first world war

03:25

until second world war

03:27

second phases

03:30

03:33

1950s 1960s use of computers use of

03:37

programmable

03:39

automation

03:40

logic controllers

03:42

that we call

03:44

third industrial revolution

03:47

and it goes until today and today we are

03:50

shifting into

03:52

fourth industrial revolution

03:56

some resources indicate that second

03:58

revolution ends by world war one

04:02

so some people talk about

04:04

first phase

04:06

as second industrial revolution

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

04:11

so

04:12

let's think about

04:15

discuss

04:19

certain dates

04:21

1901 vacuum cleaners

04:23

1902 air conditioning

04:26

automated team making 1903

04:29

electrocardiogram

04:32

first flight

04:34

with an engine

04:37

airplane

04:39

1904

04:41

radar

04:43

tbx

04:44

diodes

04:46

so

04:47

letting

04:48

electric current in one direction

04:53

1905

04:54

plastic windscreen wipers in cars

04:59

silencer for guns which is very

05:02

important

05:07

1906 is the first day for radio

05:11

broadcasting

05:14

1907 electric washing machine

05:18

1908

05:19

coffee filters

05:21

water coolers

05:22

paper cups assembly line production by

05:25

ford model t

05:27

first affordable motor car

05:31

cheap manufacturing with assembly line

05:35

1910

05:39

gas discharged neon lamps

05:42

or nightclubs

05:45

signs

05:57

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

this is the vacuum tube

06:00

as i said diode

06:02

that is the vacuum tube example of

06:04

vacuum tips these are some of them are

06:06

diodes some of them are triodes some of

06:09

them are pantods

06:11

depending on how many diodes and how

06:13

many

06:13

what kind of function you have

06:17

they were produced in

06:21

large quantities and in

06:24

lamp in vacuum tube shapes

06:27

why is it vacuum tube because there are

06:29

filaments

06:31

heated

06:32

heated wires inside heated wires and

06:35

voltages high voltages

06:37

inside generally generally the idea is

06:42

when there is

06:48

potential difference

06:52

between two

06:53

locations in the tube and when you hit

06:58

this part

06:59

not this point at this point

07:02

when you hit right part electrons

07:07

fly

07:08

from one location to another

07:11

but not the other

07:13

direction

07:14

so electrons start flying

07:17

when you say electrons start flying then

07:20

you can control the way of

07:24

the amount of amount of flow can be

07:27

controlled

07:28

so early forms of transistors using

07:31

vacuum tubes

07:32

can be made

07:34

so switching operation

07:36

turning on and off electronically

07:38

is possible and it is in it is

07:42

implemented by john fleming

07:47

that is diode one way

07:49

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

the diode invented in 1904

07:53

by john fleming contains only a heated

07:55

electron emitting cathode and anode

07:59

which one is minus

08:02

this is minus

08:05

this is plus

08:08

so heated one is the cathode

08:11

therefore

08:12

later

08:13

we we say

08:15

cathode ray tube

08:18

Crt(cathode ray tube) so the name of crt comes from

08:21

cathode ray tube so cathode rays hits to

08:24

the screen gets eliminated by phosphorus

08:28

then

08:29

they built a television

08:32

using cathode ray tubes and they also

08:34

built oscilloscopes early times of

08:39

visualizing device for the electrical

08:41

signals

08:44

electron can only flow one in one

08:46

direction through the device from

08:48

cathode to anode not from anode to

08:51

cathode so

08:52

if you have a

08:55

sinusoidal wave

09:00

this part is blocked only one part only

09:03

positive sides for example

09:05

can be allowed to pass

09:07

therefore

09:08

you can make a rectifier

09:11

that is one application

09:15

and adding more control to that behavior

09:19

gives you

09:20

ability to

09:22

turn on and off certain a certain

09:28

current

09:29

and therefore

09:30

enable to enable you to make

09:34

computers

09:35

computation devices

09:38

like turning on and off something

09:47

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

three terminal

09:49

tube amplifying tube is named as audio

09:53

tube

09:54

later

09:55

it is named as

09:57

triot

09:59

one is control one is anode one is

10:01

cathode

10:02

control

10:04

that later

10:06

turns into transistor with three legs

10:09

control input output

10:12

right

10:14

as the as the first electronic amplifier

10:19

they were very important in long

10:21

distance telephony,

10:24

When you call the telephone adana

10:27

Çekil aradan and united states is very big country

10:30

from california to new york only one

10:32

wire

10:33

and shouting from one place to

10:36

another place

10:38

was not enough so in the middle

10:40

they need to have amplifiers

10:43

and those amplifiers were made by audio

10:47

yeah audio

10:48

tubes or triodes

10:50

so that the voice signal can be

10:53

amplified

10:54

on the way multiple times

10:59

later these tubes because you can

11:01

control you can control

11:04

the current depending on your voice

11:08

with your voice

11:10

and with other signals

11:12

that allowed people to make radio

11:14

transmitters connect one one end of the

11:18

current to antenna

11:22

therefore make a broadcast

11:25

using the tube otherwise you cannot

11:31

therefore electronics revolution we say

11:35

arguably began with the invention of the

11:37

triode vacuum tube

11:39

like that makes a good exam question

11:41

though

11:43

what is the

11:46

landmark of the electronics level

11:48

revolution in 20th

11:54

century this is the

12:00

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

this is the first

12:01

tube audio tube

12:04

two wires and one control

12:07

uh

12:08

so using the control

12:12

i can

12:15

i can i can using the control wire i can

12:18

control the amount of current

12:20

that pass from one wire to another wire

12:28

probably left side

12:30

i'm not sure

12:33

we can check

12:38

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

these devices became key component of

12:40

electronic circuits in the first half of

12:42

the 20th century first off of the 20th

12:44

century

12:46

contains

12:47

tubes

12:52

when the tv first came out in turkey in

12:55

1970s

12:56

all the tv receivers were containing

12:59

tubes like eight tubes 10 tubes 11 tubes

13:03

for

13:03

amplification of signals and driving the

13:07

driving the

13:08

screen

13:10

everything because there were no

13:11

transistors solid state transistors

13:14

there were no silicon transistors used

13:16

there were only resistors resistors

13:18

capacitors and

13:20

tubes

13:24

only active device

13:26

was tubes

13:27

tubes are also

13:29

very

13:30

durable

13:34

and precise because

13:37

when we were using in 1970s

13:42

70 years were passed

13:45

so they were improved a lot

13:49

they were high power

13:50

even today

13:52

certain

13:53

devices certain

13:55

hi-fi

13:57

people

13:58

uses tube based amplifiers because they

14:02

they say

14:03

the behavior of

14:05

tube based amplifiers are more linear

14:08

they have less distortion to the sound

14:12

they were very they are very expensive

14:14

today

14:18

tubes were crucial to development of

14:19

radio television radar sound recording

14:22

reproduction long distance telephone

14:23

everything

14:25

before

14:26

digital computers and also

14:29

first computers were made using tubes

14:38

although some applications had used

14:40

earlier technologies such as such as

14:42

spark gap transmitter marconi used spark

14:45

cap transmitter

14:50

when you

14:56

you don't remember am radio

15:03

when you are using am radio in the car

15:09

if you don't use special filter

15:13

what you hear is

15:15

a big noise

15:20

which is very

15:22

related to the engine

15:24

so engine noise can be heard from radio

15:30

or

15:32

if you have a moped

15:34

going by the street

15:38

your radio picks up the

15:40

parasitic signal

15:43

and if you if you live in a very crowded

15:47

street

15:48

occupied by cars and mopeds especially

15:51

mopeds

15:53

because there is no filter in it

15:55

in their circuit

15:57

they broadcast

16:00

electromagnetic waves

16:02

because there is a spark

16:06

occurring in the ignition there is spark

16:11

right

16:12

in the spark plug so that spark

16:17

also generates electromagnetic radiation

16:19

that radiation is actually broadcast

16:24

i can turn on and off that broadcast

16:27

Sparking or not sparking

16:32

and

16:33

if i am inside the house and someone is

16:35

trying to tell me something from the

16:37

outside

16:38

i can communicate right

16:40

that is how marconi

16:43

invented

16:44

the long distance

16:47

telegram using spark spark spark no spark spark no sparks so zeros and ones

16:53

with the morse alphabet

16:56

sent wirelessly from london to

17:00

new york or but some some city i don't

17:03

know

17:04

to can ada i think

17:07

so that is how wireless

17:11

transmitter is

17:15

working actually what they do is they

17:18

connect one end of the spark plug

17:21

because it is not a moped anymore or not

17:24

a car anymore

17:25

one end of the spark plug is connected

17:28

to antenna

17:30

so if something if spark is occurring

17:33

one end is the ground another end is the

17:36

antenna and there is a coil on the other

17:38

side that loads

17:41

electricity into antenna circuit

17:46

on the other side

17:48

you have a switch when you press it

17:51

sparks

17:52

if you release no spark

17:55

and you hear that parasite

17:58

from new york

18:00

with the same size of antenna

18:04

that's how they transmitted

18:08

waves

18:12

but with the tubes

18:15

it is improved a lot

18:18

you don't need to have spark gap

18:20

transmitter and you can

18:22

you can you also have the ability you

18:24

also have the ability to

18:26

uh transmit in a frequency that you

18:30

calculate and you

18:32

generate because you can make an

18:34

oscillator

18:36

at certain frequency with

18:39

tubes

18:44

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

edison

18:46

this is the guy

18:49

who started

18:50

research

18:52

in

18:53

Organized, industrial

18:55

way

18:57

he bought

19:00

a lot of land in the city blocks blocks

19:03

blocks of houses and

19:05

made turned

19:07

those houses

19:08

into factories

19:10

in new jersey

19:12

today

19:13

the place

19:15

the town is

19:16

named as eduson so the region is

19:20

known as edison there is a museum for

19:22

him

19:26

at some point he was working with a lot

19:29

of people uh generating

19:31

various different inventions not only

19:33

one invention

19:35

we

19:36

we know

19:37

him for inventing the light bulb but

19:39

light bulb is only one invention of his

19:42

there are many inventions

19:44

one of the important part is the

19:46

electric power generation edison power

19:49

generation

19:50

For example sound recording

19:53

gramophone

19:55

motion picture

19:58

animation

20:00

battery

20:03

rechargeable battery rechargeable

20:10

yeah rechargeable car battery

20:16

these inventions phonograph motion

20:19

picture camera early versions of the

20:21

electric light bulb

20:22

has a lot of effects

20:27

he was the first inventors of the

20:31

inventors to apply principles of

20:33

organized science and teamwork to the

20:36

process of invention before

20:38

invention is done by rich people or

20:40

crazy people or scientists university

20:43

professors

20:44

that usually work

20:46

alone with edison

20:50

he looked

20:51

the thing

20:53

commercially

20:56

made research and turned into turn that

20:59

into

21:00

profit

21:03

so organized research lab

21:06

notion

21:07

came out

21:09

industrial research laboratory

21:12

terms

21:13

augmented

21:17

some of them electrographic vote

21:19

recorder

21:21

voting machine

21:22

the first patent

21:24

this device permitted waters to push yes

21:26

or no switch instead of writing their

21:28

wall

21:29

or pushing yes or no instead of writing

21:32

yes or no

21:33

a push button

21:35

vote recorder it was recording

21:40

the vote onto paperwriting

21:42

by checking the marks

21:46

there is an electromagnet inside

21:49

so

21:50

paper is

21:51

at the end the paper contains number of

21:54

words yes's or nose in different

21:57

places

22:00

automated telegraph

22:03

because the line is busy

22:05

you write the telegraph

22:07

before and fit this to the machine

22:10

so the machine sends it automatically

22:12

like a modem so this is the early way of

22:15

inventing a modem

22:17

uh

22:18

network device first you write your

22:20

message slowly then feed it to

22:24

automated telegraph machine a telegraph

22:26

machine sends it as fast as it can

22:28

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

therefore

22:30

this technology

22:32

increased words transmitted permits from

22:34

25 to 1000

22:37

a lot of speed improvement

22:40

before

22:41

that was dependent on

22:44

[Music]

22:46

the person who is sending it

22:48

but later

22:50

[Music]

22:54

that requires no one to tap out the

22:56

message at receiving it

23:00

it automatically prints

23:06

later edison produced speaking telegram

23:15

electric pen

23:19

preceded by the perforated pen

23:21

which punched holes in the telegraphs

23:25

there is hole or no hole no hole so it

23:28

records messages

23:30

this pen created

23:32

a tip as the as the user wrote

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

23:38

it draws a mark

23:40

which could be used to press ink onto

23:41

paper

23:43

and make duplicates

23:45

join

23:48

it can used as

23:51

it can be used as

23:52

replicator of certain messages

23:56

electric pen

24:00

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

phonograph is the sound recording device

24:04

edison created multiple versions of this

24:06

sound recording

24:08

device

24:09

which is the father of the sound

24:11

recording and film recording

24:15

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

telephone

24:16

the carbon telephone i have explained

24:19

this carbon telephone last time in the

24:21

lecture

24:22

uh

24:24

there was a weak point in alexander

24:26

graham bell's phone the transmitter part

24:29

the initial version used

24:32

magnate

24:34

as the dust but edison

24:37

decided to use carbon

24:42

battery means doesn't doesn't mean that

24:43

battery here

24:45

it it

24:46

the carbon

24:48

plays carbon box

24:51

that box increased the

24:53

stability and

24:55

since there is more current flowing

24:58

distance that you can speak

25:00

is increased

25:02

controlled with your voice

25:08

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

light bulb

25:09

so light bulb was important

25:12

important

25:14

there were also previous attempts but

25:16

the previous attempts were very

25:18

short-lived

25:20

edison's lamp was very long

25:22

living

25:24

so that it is commercially viable

25:31

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

this is one edison power generation

25:34

houses edison

25:39

designed

25:40

to

25:42

design devices to make power

25:45

for houses and

25:47

illumination

25:51

electric for electric lighting

25:53

and he was the

25:57

he was the

25:58

defender of

26:00

dc power

26:03

and with the design that he created here

26:10

he designed a network of houses

26:13

that can be supplied by dc voltage

26:18

this dc voltage

26:20

[Music]

26:22

is distributed to the houses nearby

26:24

because it cannot be sent to longer

26:27

distances

26:28

due to

26:30

resistive losses in the wires

26:34

for example in this building

26:36

they were able to that one is the first

26:39

street station is the famous

26:41

in manhattan

26:43

a 27 machine that produced

26:46

100 kilowatts enough to power

26:49

1200 lights

26:52

if you installed three lights per home

26:55

that means 400 homes were eliminated

26:58

using this

27:00

power generation system

27:06

the patent

27:07

date is 1881

27:11

so that

27:12

that's the same year that

27:14

ataturk was born

27:27

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

electric generator

27:29

he designed a motor to help to control

27:31

the supply of electricity between

27:33

devices

27:34

concepting many

27:38

concept in many of his creations like

27:40

lamp that is for controlling

27:45

electric motor but there is a governor

27:48

here

27:49

that governor rotates at a certain speed

27:52

so depending on depending on the

27:57

supply and demand it can control itself

28:01

at the same

28:04

level of voltage

28:09

that's again 1881

28:14

speaking loud loudspeaking telephone

28:17

named as

28:18

uh motograph this device

28:21

lowered electrical currents from high to

28:23

low

28:24

that allowed changes in production

28:27

levels like dimers lights or louder

28:29

telephones

28:31

so

28:32

with

28:33

with the

28:34

with the help of transformers

28:39

he was able to increase or decrease

28:43

level of

28:44

signal

28:56

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fuel cell

28:58

edison became one of the many in long

29:01

line of attempt to create the modern

29:03

fuel cell that was the fuel cell not the

29:05

battery fuel cell battery a device that

29:08

could produce energy from reaction

29:10

between hydrogen and oxygen leaving only

29:12

water as a by-product so hydrogen fuel

29:14

cell is invented by thomas edison

29:18

and this is his drawing

29:22

but actually

29:23

it is not

29:24

manufactured later

29:26

until

29:27

recent time

29:35

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

universal stock printers prints stocks

29:38

and

29:39

used by

29:40

western union

29:48

their people were interested in prices

29:50

in this

29:51

certain stocks new york boston chicago

29:54

etc

29:55

so they were able to get these prices

29:58

by

29:58

checking the

30:00

ticker actually

30:02

maybe the

30:03

stock ticker that we see

30:06

rolling

30:09

text

30:11

in today's screens has origins

30:16

dating back to this

30:18

edison stock printer

30:27

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

he was also interested in mining

30:30

with the centrifuge centrifugal force

30:34

because he was aware of the fact that

30:38

different

30:39

materials have different

30:43

densities

30:45

right

30:46

uh using

30:48

centrifugal force can separate

30:51

different ores from the rocks

30:54

rocks are lighter

30:56

iron is for example

30:58

heavier

30:59

so or gold so using centrifugal force he

31:04

was able to

31:06

separate

31:08

magnetic and non-magnetic materials or

31:11

milling machines etc

31:17

um

31:19

today for example

31:21

uranium

31:23

or many other ores are

31:25

separated using these centrifugal forces

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

31:32

camera edison so to design an instrument

31:35

that does for the eye what does

31:36

phonograph does for the ear so after

31:39

invention of the phonograph he thought

31:42

can we do this for the eye

31:44

can we record

31:47

what people see

31:49

so he

31:51

he tried to

31:53

make a camera that takes pictures one

31:56

after another a basic very primitive one

32:01

six pictures

32:03

so

32:04

the camera

32:06

recorded

32:07

as you take the pictures

32:09

six pictures one after another

32:11

so the camera showed photos in rapid

32:13

succession one after another

32:16

so that people will see it

32:17

in moving

32:19

fashion

32:21

that is very short but

32:24

that was the kinetographic camera

32:26

it is kind of what we have today in

32:29

iphones very short

32:33

very short photographs with slight

32:35

movements so that it looks

32:38

more natural

32:40

like one second photographs

32:46

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

alkaline battery is also invented by

32:49

eduson

32:52

uh longer lasting batteries rather than

32:55

iron and nickel

32:58

there was a huge

33:00

market for this and that was very

33:02

successful in later years of edison and

33:05

the company

33:09

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

he also invented

33:10

the cement

33:14

uh

33:17

not the cement but cement production

33:20

so

33:22

his company edison port and cement

33:26

made this cement product

33:28

chimento

33:29

commercially available and the name of

33:31

the

33:33

chimento cement

33:36

later known as portland cementosu

33:39

because the company names was edison

33:41

portland cement

33:46

that is what we

33:48

use today

33:50

in çimento industry

33:55

that he he find

33:58

the way of production

34:00

not the substance

34:04

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

further

34:06

in those years

34:08

stenotype machines

34:11

Ecstasy,brillo pads crossword puzzles ,bras

34:15

zips plus sonar

34:18

1916.

34:20

for submarines and ships

34:23

hair dryers

34:25

submachine guns lipstick etc

34:30

after second world war

34:32

robots insulin

34:36

kitchen cookers

34:39

kitchen gas cookers or

34:43

not gas cookers but

34:48

call cookers

34:50

but similar to what we have today so

34:52

that you can put your

34:55

uh

34:59

put your

35:00

put your uh

35:03

food onto it to cook

35:06

put to put the pan on it

35:10

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

i have the picture actually this is

35:24

before that there was nothing

35:33

uh

35:34

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

hearing aids 1923

35:37

frozen food

35:39

1924

35:42

giger counter television invention of

35:44

television goes back to 25.

35:48

liquid filled rocket

35:49

toaster sprays

35:53

sound in movies 1927.

35:58

penicillin

36:00

iron lung is very

36:02

interesting device

36:05

i am going to show that

36:08

jet engine 1930

36:14

artificial life

36:19

as a concept

36:23

as a concept

36:24

such as drops similar to robots so

36:27

calling something as

36:29

artificial

36:33

this is what “aga cooker”

36:36

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

this is model t

36:38

serial

36:39

production

36:40

and the number of

36:43

number of cars that are sold is 15

36:45

million

36:46

this 15 million i think is more than

36:49

toyota corolla

36:51

or something close

36:57

top 10 list of most sold cars of all

37:00

time

37:03

eight it is at the eighth level top time

37:23

[Music]

37:32

foreign

37:47

foreign

37:57

the cheapest one is 290

38:02

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Hubble (teleskopu olan Hubble) 1924 american astronomer announces that

38:38

discovery of galaxies outside the milky

38:40

way this is very important people were

38:44

unaware

38:45

unaware of

38:47

other galaxies

38:48

they were thinking that we are in a

38:50

galaxy and that's it

38:52

so

38:53

the

38:56

the space was

38:58

lived to be consisting of

39:01

some uh milky way(samanyolu)

hubble

39:06

found that there are other galaxies

39:10

and you know how many galaxies we have

39:16

yes

39:21

a lot

39:26

one

39:31

he also found that the theory of

39:34

expanding universe

39:36

right

39:38

this

39:39

expanding universe theory was also

39:43

proven

39:44

later by the

39:47

other

39:48

scientists

39:50

and then we were we are able to

39:53

determine the

39:55

size of the universe and age of the

39:58

universe

39:59

based on the big bang theory and etc

40:03

the size is too big

40:06

47:51

hubble discovered that

47:54

there are galaxies outside of the milky

47:57

way

47:58

outside of the milky way milky way is

48:00

the galaxy

48:05

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

john Logie Baird

48:08

is the inventor of british guy

48:10

is the inventor of the television

48:15

he

48:16

[Music]

48:18

this is important because

48:21

it is closely related to

48:24

it is closely related to

48:26

[Music]

48:27

computer displays and television is

48:30

directly related to computer displays

48:32

and television is a very big technology

48:35

for the world

48:37

so

48:38

first name was televised

48:40

not television televisor

48:44

there was a mechanical

48:46

as you see is a rotating disc

48:49

there is a rotating disc mechanical

48:51

scanning of certain object with the

48:53

lights

48:54

and the amount of light changes the

48:56

amount of signal and that signal is

48:58

transferred to another place and the

49:00

phosphorus and the lamp generates

49:03

similar light

49:05

ends up with the similar rotation

49:09

which can generate the image

49:15

the original

49:16

tv had

49:18

30 line mechanical scan

49:22

today

49:23

our line number of lines is

49:26

regular analog tv was 625

49:31

but in hd

49:36

we have 100 1080 lines but the original

49:40

tv had 30 lines

49:45

so the display was six centimeters by

49:48

two centimeters very small display but

49:53

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

you can see it

49:54

somebody is talking for example very

49:56

crude picture

50:00

and

50:01

television broadcast was connected to

50:04

radio broadcast so some radio broadcasts

50:06

included television signal

50:14

it is commercialized very fast

50:17

by the 1946.

50:20

in turkey there is not a television

50:23

in 1946 44 000 homes had television

50:30

but

50:32

after the war

50:34

there was a very fast

50:36

expansion

50:38

in

50:39

three years

50:40

just in three years

50:42

4.2 million tv

50:44

were available

50:50

since they had long

50:52

tubes this was vertical

50:56

and there was a mirror

51:01

the the thing you see here

51:04

is actually

51:05

at the bottom

51:06

you see the

51:09

you see the picture of the

51:12

screen using the mirror because the

51:15

tube is

51:18

positioned vertically

51:21

and once you finish with the watching

51:23

you can close the

51:26

furniture

51:29

and keep it that way

51:34

1928

51:36

tv that is the

51:38

image

51:39

original image photograph of the image

51:43

sent from the other

51:45

end

51:51

by the time

51:52

1929

51:55

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

uh there was a great depression that is

51:58

the result of

51:59

fast expansion of the

52:01

economy after the war

52:04

after the war there was a fast expansion

52:08

too many

52:10

things happened

52:11

and

52:13

couldn't keep up and there was a crisis

52:16

after the crisis

52:19

the second world war

52:21

came out to compensate that and another

52:23

growth happened

52:25

after the second world war the reasons

52:27

were very interesting uh i learned a lot

52:31

of things when when i was preparing this

52:34

last lecture

52:37

uh i'm going to share with you

52:41

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

after the crash many americans panicked

52:43

and withdraw their money from the banks

52:47

banks

52:49

didn't have the money because they have

52:51

invested the stock market

52:55

banks invested the money

52:58

for making the profit but people wanted

53:01

their money

53:02

there were no money

53:05

stocks collapsed

53:09

by the time in 1929

53:13

talking about united united states only

53:17

600 banks

53:20

failed

53:21

collapsed

53:23

600 different banks

53:29

by 1933

53:32

11 000 of the

53:35

25 000 banks

53:38

nationwide

53:39

collapsed bankrupt so there are too many

53:42

banks as you see

53:47

this is

53:48

1929 los angeles people want their money

53:52

back

53:53

from the banks bankrupt

54:03

using that

54:06

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

during that time unemployment increased

54:13

90 000 businesses

54:16

went bankrupt

54:20

gdp

54:22

gdp

54:23

reduced to

54:24

half

54:26

unemployment unemployment increased from

54:28

three percent to 25 percent

54:31

so three percent to 25 increase

54:35

uh

54:36

in a couple of years

54:41

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

the causes are very interesting and they

54:44

they might be

54:45

related to what we have

54:48

now in turkey

55:01

there was

55:02

there was a

55:04

customs tariffs (tarrifs & war debt policies)

55:06

and

55:07

debt policies

55:09

imposed by the government

55:11

to save money

55:14

so government was

55:15

reluctant to spend

55:18

second

55:22

industry is expanded they were producing

55:26

industries producing but

55:29

demand was low so

55:33

they were able to produce but nobody was

55:35

going to buy it

55:38

third farm sector

55:40

was changing

55:42

there were small farmers

55:44

small farmers were unable to keep up

55:46

with the

55:50

demand

55:52

credit was easy

55:54

many people get credit

55:56

but didn't pay back

55:59

and

56:00

distribution of income was very unequal

56:03

so

56:04

these are the signs for disaster

56:11

farming is very important and the reason

56:17

the reason of farm

56:19

crisis

56:23

was very interesting

56:25

i will talk about that later

56:30

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

These were very famous soup kitchens for the

56:32

poor people

56:33

and breadlines

56:36

[Music]

56:39

this for example was sponsored by al

56:42

capone probably

56:44

uh

56:46

similar to sedat peker of

56:48

turkey now

56:50

if something if some big if some big

56:53

crisis happens

56:55

those kind of rich people will

56:58

open up these.

57:06

end of the depression

57:08

led to another war

57:12

reason was

57:14

to

57:15

give

57:18

industry a boost

57:20

government

57:23

probably they didn't plan it but it

57:25

happened by itself

57:29

factories

57:31

were

57:32

getting orders from the government to

57:34

produce arms

57:36

therefore they were

57:39

there were jobs

57:41

to make

57:43

arms a lot of jobs were created by war

57:47

unemployment decreased and production

57:49

increased for war production

57:52

therefore great depression ends

57:55

completely

57:56

when the us enters the war

58:00

until the war until 1941 41 people were

58:04

very poor and there were unemployment

58:12

1931 electric razor electric shaving

58:16

1932 radio telescope parking meter

58:19

folding wheelchair

58:21

1933 electron microscope

58:30

what was cat's eyes i forgot

58:33

1935 electric guitar

58:36

ballpoint pen photocopy

58:39

helicopters 1939

58:50

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

as we approach the

58:52

1940s a theoretical physicist feignman

58:56

was

58:58

coming up

59:00

after

59:02

albert einstein

59:04

he was famous in quantum mechanics and

59:07

quantum electrodynamics

59:11

at the beginning of the

59:13

101 class

59:16

i shared you a video of

59:20

his

59:21

explaining how computer works so please

59:23

watch that

59:25

if you didn't

59:28

he

59:29

worked in super super fluidity super

59:33

cold liquid helium

59:35

and also he worked in development in

59:38

atomic bomb actually he probably the guy

59:40

who developed atomic bomb in second

59:43

world war

59:47

later

59:51

later he was in

59:52

space shuttle disaster

59:55

investigation team

59:58

he has been credited with pioneering the

60:00

in the field of quantum computing and

60:02

introducing the concept of

60:04

intrusive introducing the concept of

60:06

nanotechnology

60:08

richard feynman

60:11

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

he was also interested in turkish

60:13

language

60:15

spoken in

60:16

east asia

60:22

that's the place

60:24

there was a place called tua in mongolia

60:29

he learned the language it is turkish

60:32

language

60:33

he couldn't go there because it was

60:35

soviet time russian time

60:39

and

60:46

his friends arranged a conference visit

60:51

to theirs

60:53

but

60:54

he died before the conference is

60:57

arranged so he couldn't go there but

60:59

college's british colleges his colleague

61:01

colleagues

61:03

finished the visit and later there was a

61:05

statue erected in the

61:07

in the city center

61:10

but later destroyed by the people

61:14

nobody cared

61:17

that is the place

61:22

he has a book about tour

61:30

the atomic bomb

61:32

development of atomic pump is very

61:35

is a big cornerstone

61:37

in

61:39

at the end of the second

61:40

industrial revolution

61:43

a lot of important people an important

61:45

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

name appears here

61:48

such as Robert Openheimer,Vannevar Bush,Chadwick James,Albert Einstein,Fermi Enrico,Richard Feynman,Teller Edward,Wigner Eugene,York Herbert

62:02

foos

62:04

others i don't know maybe they are

62:07

probably they are important people but i

62:08

don't

62:09

so these are the famous physics

62:12

people

62:13

and e lectrical engineering people

62:16

in the world so they have different labs

62:19

in

62:20

in hanford oak ridge matlab

62:24

los alamos los alamos has the biggest

62:28

lab for the

62:32

atomic bomb project this is one

62:36

this is one uh

62:39

picture from the los alamos lab

62:44

ladies controlling power generation or

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

62:46

something like that and one important

62:50

interesting thing is

62:51

they found

62:53

one of these ladies

62:54

in recent years

62:56

and made an interview

62:58

and that those ladies didn't know that

63:01

they were developing atomic bomb

63:04

i said

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

63:10

and 1942

63:13

first nuclear reactor built

63:15

napalm bombs

63:18

invented and used against japan

63:22

a kidney dialysis machine

63:25

is invented nuclear bomb is used

63:27

microwave one is invented

63:31

transistors holograms artificial

63:33

intelligence disposable

63:35

napkins

63:36

mobile phones 1947

63:41

general purpose computation

63:44

1948 credit cards

63:46

self-cleaning house

63:48

and

63:49

bipolar junction transistor

63:51

is invented in 1950

63:55

that's it for

63:56

today uh

63:58

i hope you enjoyed it

64:00

i hope you enjoyed the video

64:03

because it is too interesting

64:07

please

64:08

please watch the same video

64:12

this

64:15

star size comparison 2

64:20

and the number of view is

64:24

39 million

64:27

so it is a famous video

64:31

there is a co there is a

64:36

counter video on this

64:40

showing the

64:42

space

64:44

as you magnify

64:48

the atoms

64:49

goes deeper and deeper and deeper

64:52

that's also

64:53

interesting to watch

65:00

okay

65:02

people at home

65:08

you