

A genesis of commercial ultrasonic device development in the United States 1947-1974

The work of Lewis Balamuth, Arthur Kuris
and Claus Kleesattel

Presented by Dave Wuchinich

Early investigators in low frequency power ultrasonics

Warren P. Mason – Bell Laboratories, U.S.

Reimas Pohlman – Pohlman Institute, Germany

L. D. Rosenberg – Acoustic Institute, Soviet
Union

Ernest Neppiras – Mullard Laboratories, Great
Britain

Robert McMaster – Ohio State, U.S.

Early U.S. companies engaged in commercial development of low frequency, high power ultrasonic equipment:

Cavitron Ultrasonics, Long Island City,
NY (1947)

Aeroprojects, West Chester, PA (1953)

Branson Ultrasonics, Danbury, CT
(1946)



Lewis Balamuth



Arthur Kuris



Claus Kleesattel
Director of Research

Founders of Cavitron 1947

Cavitron

Early developments - and
continual commercial failures

ULTRASONIC WORKS

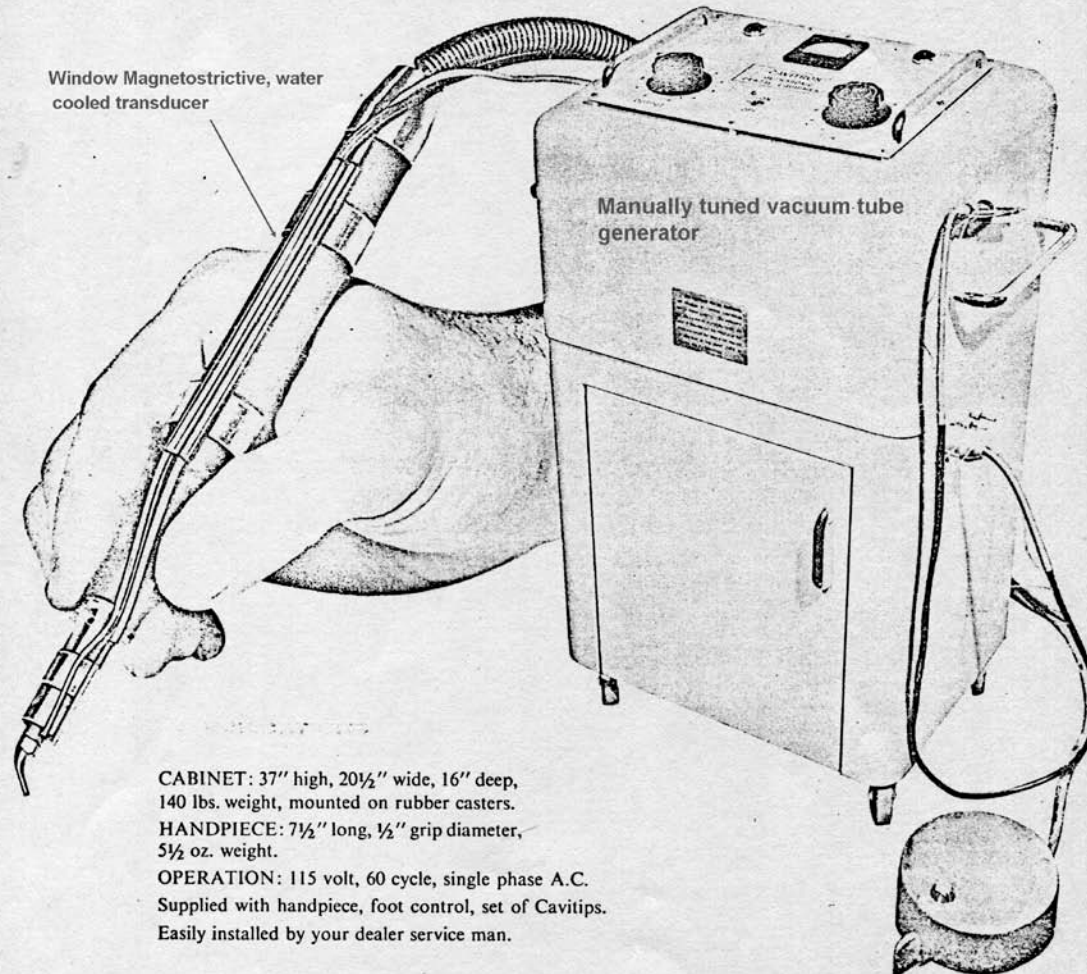
The Cavitron Ultrasonic Cutting Process provides a new mechanical cutting method for dentistry which is simple, precise and without the principal objections to standard rotary tools—the noise, vibration and heat that contribute so greatly to dental pain and discomfort.

In the Cavitron Dental Unit, electrical impulses are converted within the handpiece to mechanical oscillations at the rate of 29,000 times per second and .0014" in length. These oscillations are carried to the Cavitip (cutting tool) and transmitted to abrasive particles introduced between Cavitip and tooth. High-acceleration, low-velocity motion imparted to each abrasive particle by the Cavitip causes the particle to strike the tooth with a microscopic impact, producing rapid, gentle, controlled cutting action.

Because abrasive motion occurs only under the tool tip, cuts reproduce the shape of the Cavitip and provide sharply defined line and point angles; walls and floor of the cut are smooth and require no additional finishing. Thus preparations can be completed quickly with a minimum of tool changes and supplementary instrumentation.

Since the Cavitron process eliminates the need for rotating parts in the handpiece, there is no torque and no noise and vibration during cutting. Fine tactile control is easily maintained.

Ultrasonic Dental Drill



CABINET: 37" high, 20½" wide, 16" deep,
140 lbs. weight, mounted on rubber casters.

HANDPIECE: 7½" long, ½" grip diameter,
5½ oz. weight.

OPERATION: 115 volt, 60 cycle, single phase A.C.

Supplied with handpiece, foot control, set of Cavitips.

Easily installed by your dealer service man.



Balamuth and the
Ultrasonic
Toothbrush !!!

Lewis Balamuth, one of three investors to get a patent on ultrasonic toothbrush designed to remove plaque.

Sonic Vibrations Give Massage

Relief of Tensions in a Special Tub May Be Possible

By STACY V. JONES

Special to The New York Times

WASHINGTON, March 13—
A New York scientist proposes to treat many of mankind's ills with vibrations in the sonic or ultrasonic range. He expects, for instance, that electrically powered biosonic walls installed in a bathtub will relieve tension by massaging human cells.

Patents
of
Week

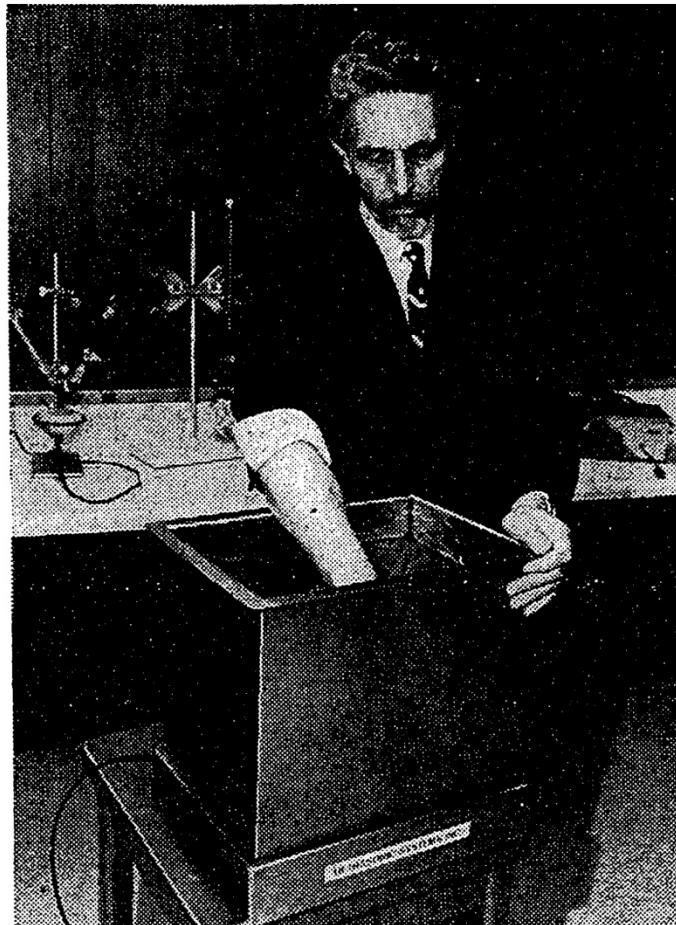
Dr. Lewis Balamuth was granted two patents this week for ways of transmitting electric waves of energy through man, animals and plants.

Patents 3,499,436 and 3,499,437 are assigned to Ultrasonic Systems, Inc., Farmingdale, N. Y. The company, which manufactures ultrasonic motors, is discussing with tub makers the construction of equipment for human treatment. Dr. Balamuth is research director of the company.

The broad objectives of the patents are to benefit the skin, nerves, muscles, circulation, hair, teeth, digestive tract and other body organs.

It is expected that fertilized ova can be influenced to produce bigger cattle and hogs, and that seeds can be treated to stimulate growth in field, forest and sea.

The wavelength is to be regulated according to the treatment. Vibration is to be



Dr. Lewis Balamuth demonstrating his new tank with a vibrating wall which produces a massage using ultrasound.

continuous in the low range, and in pulse at the higher rates, up to a million cycles per second.

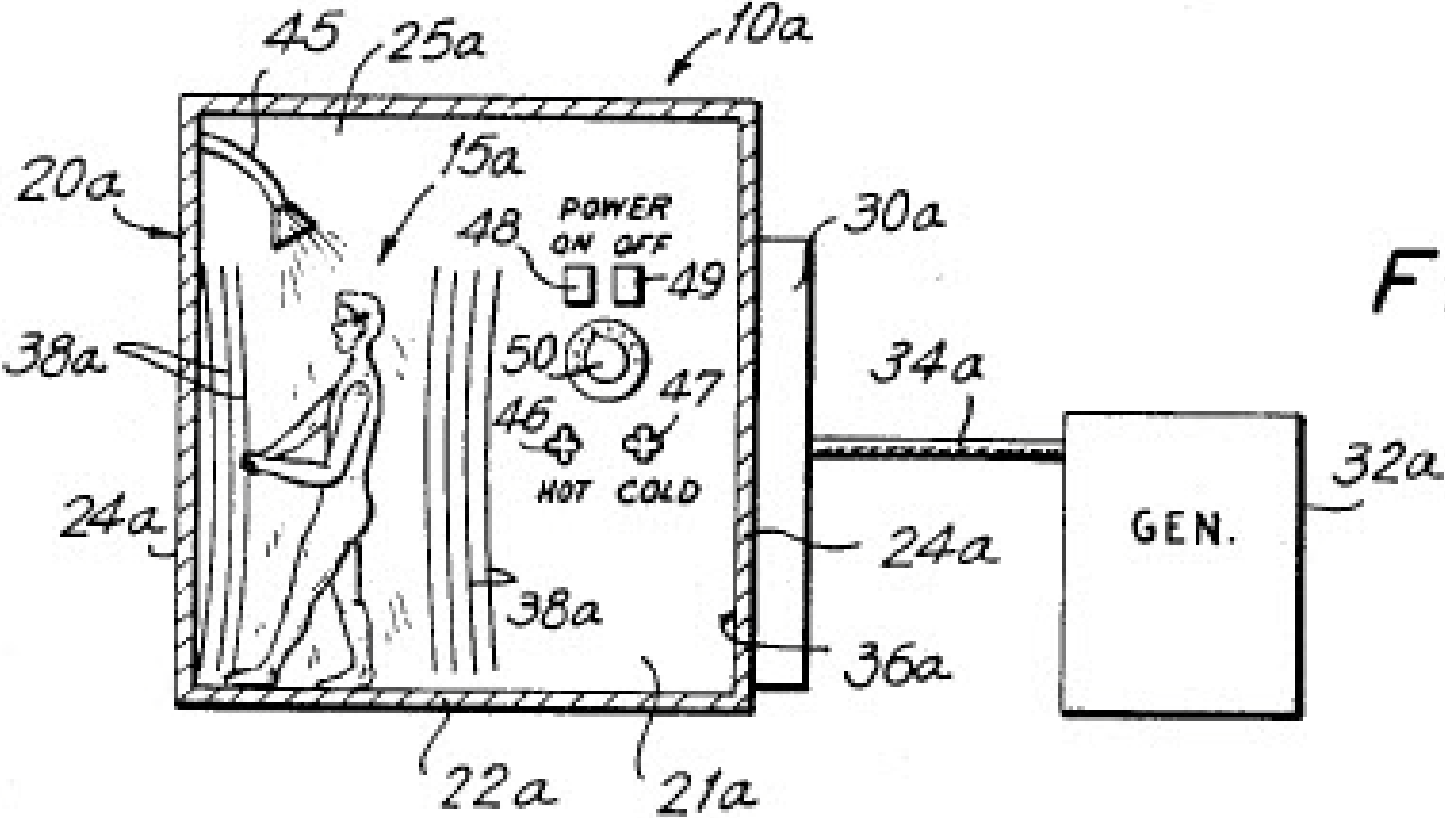
Dr. Balamuth said this week that his psychedelic bathtub could combine music and color with vibrations to supply a drugless tranquilizer

or to stimulate the depressed.

The inventor has been granted many earlier patents in ultrasonics. His periodontal instrument is widely used for cleaning teeth, and other methods to assemble plastics,

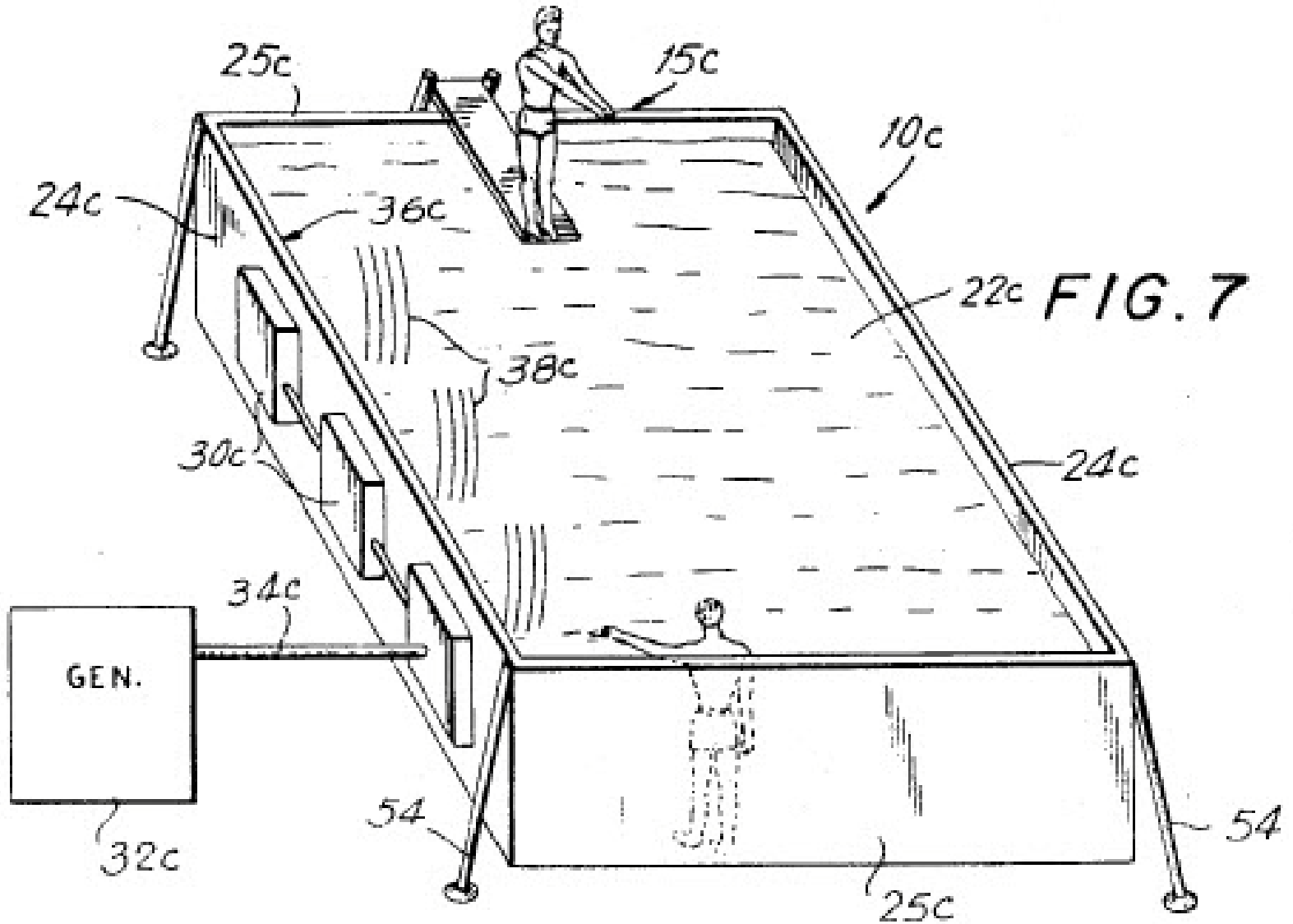
Continued on Page 49, Column 2

FIG. 5



Ultrasonic Shower

Ultrasonified Swimming Pool



[54] **ULTRASONIC REPLACEABLE SHAVING HEAD AND RAZOR** 3,509,626 5/1970 Mead..... 30/45
 3,610,080 10/1971 Kuris..... 30/45 X

[75] Inventors: **Arthur Kuris**, Riverdale; **Lewis Balamuth**, New York; **Anthony P. Farina**, Centereach, all of N.Y.

FOREIGN PATENTS OR APPLICATIONS
 929,363 12/1947 France..... 30/45

[73] Assignee: **Ultrasonic Systems, Inc.**, Farmingdale, N.J.

Primary Examiner—Othell M. Simpson
Assistant Examiner—Gary L. Smith

[22] Filed: **Dec. 3, 1971**

[21] Appl. No.: **204,632**

[52] U.S. Cl..... 30/45, 310/8.2, 310/8.3
 [51] Int. Cl..... H01v 7/00, B26b 21/00
 [58] Field of Search..... 30/45, 272 A; 310/8.2, 8.3

[56] **References Cited**
UNITED STATES PATENTS
 2,721,382 10/1955 Beauchaine..... 30/45

[57] **ABSTRACT**
 A shaving head for use, in combination with a handle containing an ultrasonic motor, said head including a blade disposed therein and mounted therein in a manner to be ultrasonically vibrated with the head detachably and rigidly coupled to the ultrasonic motor.

58 Claims, 24 Drawing Figures

Ultrasonic Razor

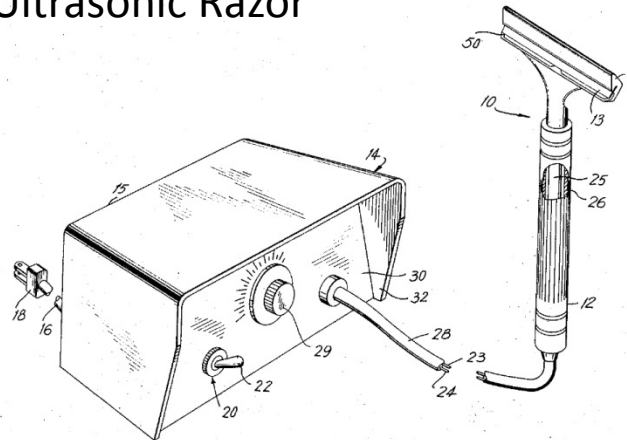


FIG. 13

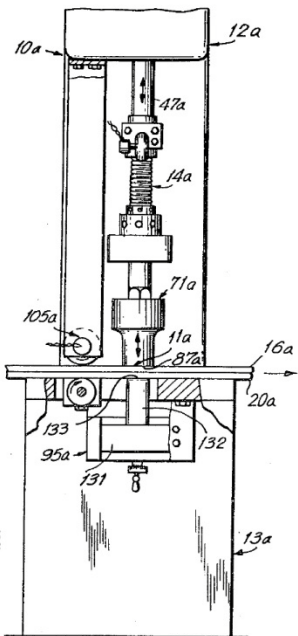
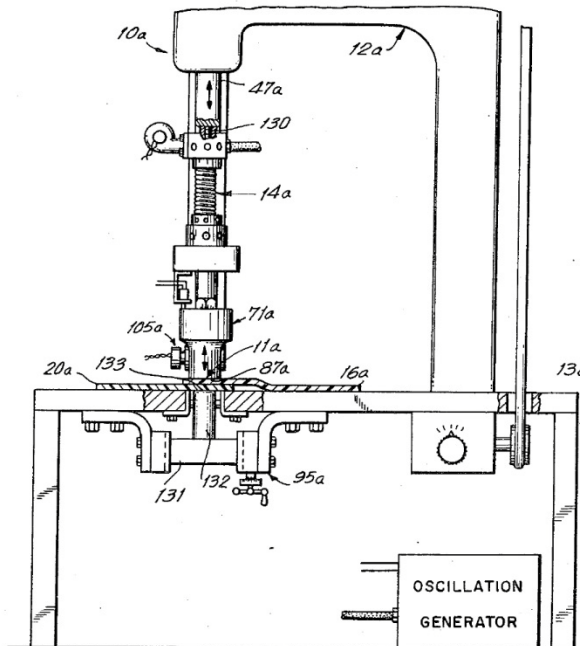


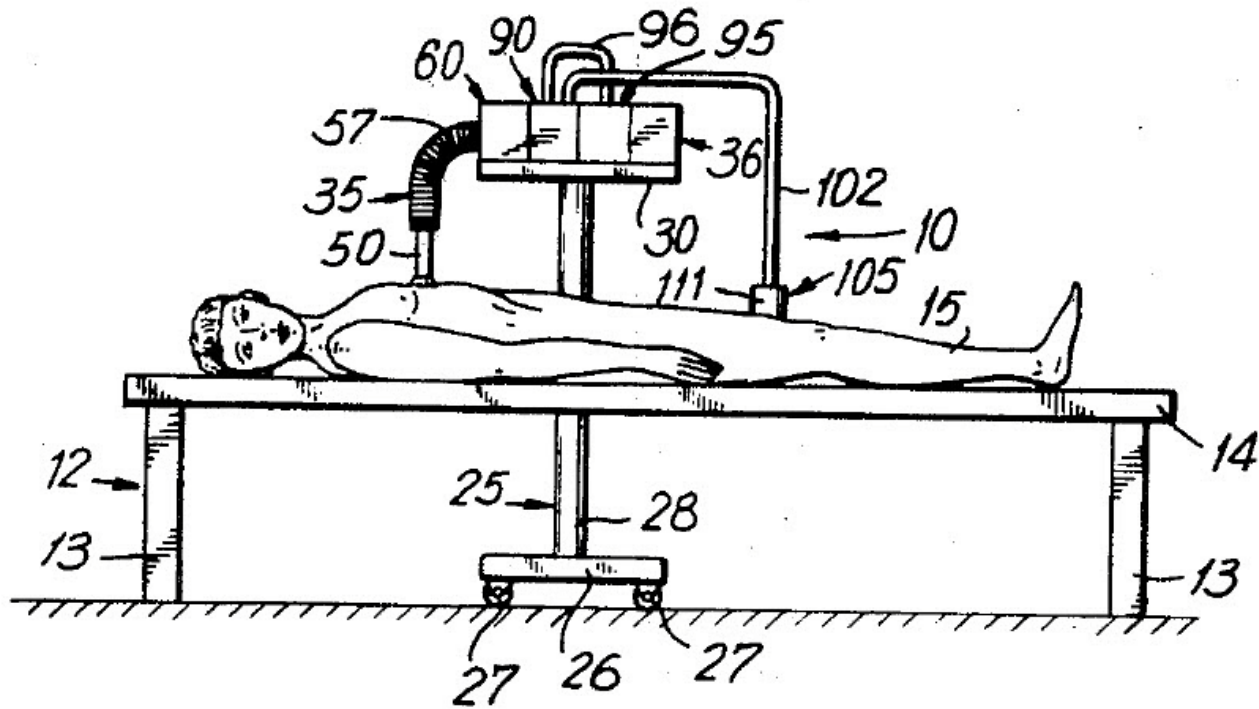
FIG. 14



INVENTORS
 LEWIS BALAMUTH
 CLIFFORD A. ROBERTSON
 BY *Edward W. Smith*
 ATTORNEY

May 20, 1969
 L. BALAMUTH ET AL.
 METHOD AND APPARATUS EMPLOYING VIBRATORY
 ENERGY FOR JOINING MATERIALS
 Filed Aug. 3, 1965
 3,445,307
 Sheet 4 of 5

Ultrasonic Sewing Machine for thermoplastic fabrics



Ultrasonic Tissue Grafting

March 10, 1970

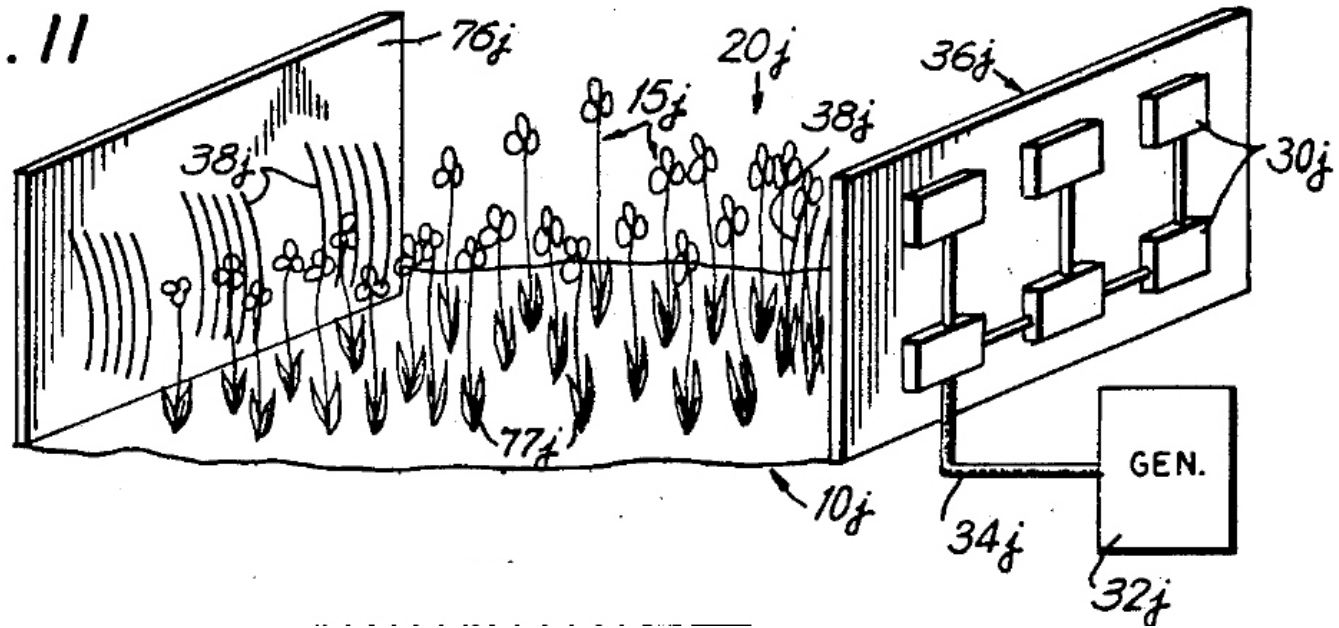
L. BALAMUTH
METHOD AND APPARATUS FOR TREATMENT OF ORGANIC
STRUCTURES AND SYSTEMS THEREOF
WITH ULTRASONIC ENERGY

3,499,437

Filed Sept. 11, 1967

4 Sheets-Sheet 4

FIG. II



Ultrasonic Farming

Cholesterol Treatment Devised

Ultrasonic Method Utilized to Detect and Remove It

By **STACY V. JONES**
Special to The New York Times

WASHINGTON, Feb. 26—
A Long Island inventor pro-
poses to detect the build-up
of cholesterol in the human
circulatory system and to re-
move it, in either case, by

ultrasonic vibra-
tions. Arthur Ku-
ris was granted
Patent 3,565,062
this week for the
method and ap-
paratus to be used in dis-
lodging the deposits from the
blood vessels. A second pat-
ent has been allowed and will
be issued to him soon for the
diagnostic procedure. Both
are assigned to Ultrasonic
Systems, Inc., Farmingdale,
of which Mr. Kuris is pres-
ident.

To get rid of cholesterol or
other deposits that have col-
lected in a section of artery
or vein, the surgeon is to in-
sert a hollow catheter and
through the catheter a hand-
held probe vibrating at a
frequency above the limit of
human hearing. The particles
dislodged from the walls of
the blood vessel can be
washed away with an anti-
septic liquid.

Mr. Kuris reports that the
normal movement of blood
through the body creates

Continued on Page 39, Column 2



Arthur Kuris, inventor of ultrasonic means of detecting and removing cholesterol, with a device that initiates vibrations in circulatory system. He received a patent.

The New York Times

Published: February 27, 1971
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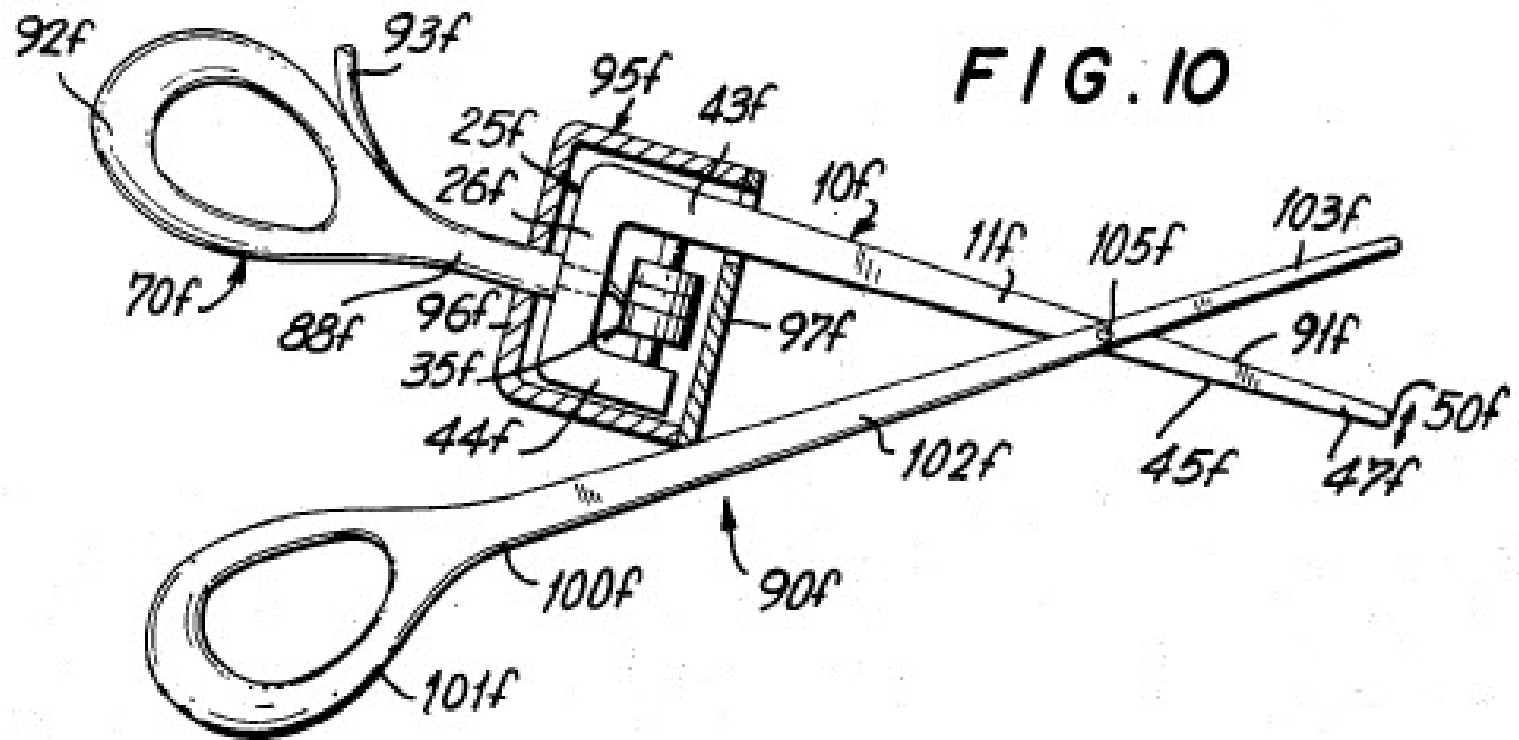


FIG. 10

Ultrasonic Scissors

And, the successes



Cavatron Model 660 dental scaler circa 1963

Vacuum tube generator
Magnetostrictive solenoid
type, water cooled transducer



[Cavitron Select SPS Ultrasonic Scaler \(Dentsply\)](#)



[Scalex 800 Ultrasonic Scaler \(DENTAMERICA\)](#)



[Scalex 850 Self Contained Ultrasonic scaler \(Dentamerica\)](#)



[Cavitron® BOBCAT® Pro Ultrasonic Scaler \(Dentsply\)](#)



[Cavitron Jet Plus Ultrasonic Scaler \(Dentsply\)](#)



[Cavitron Plus Ultrasonic Scaler \(Dentsply\)](#)



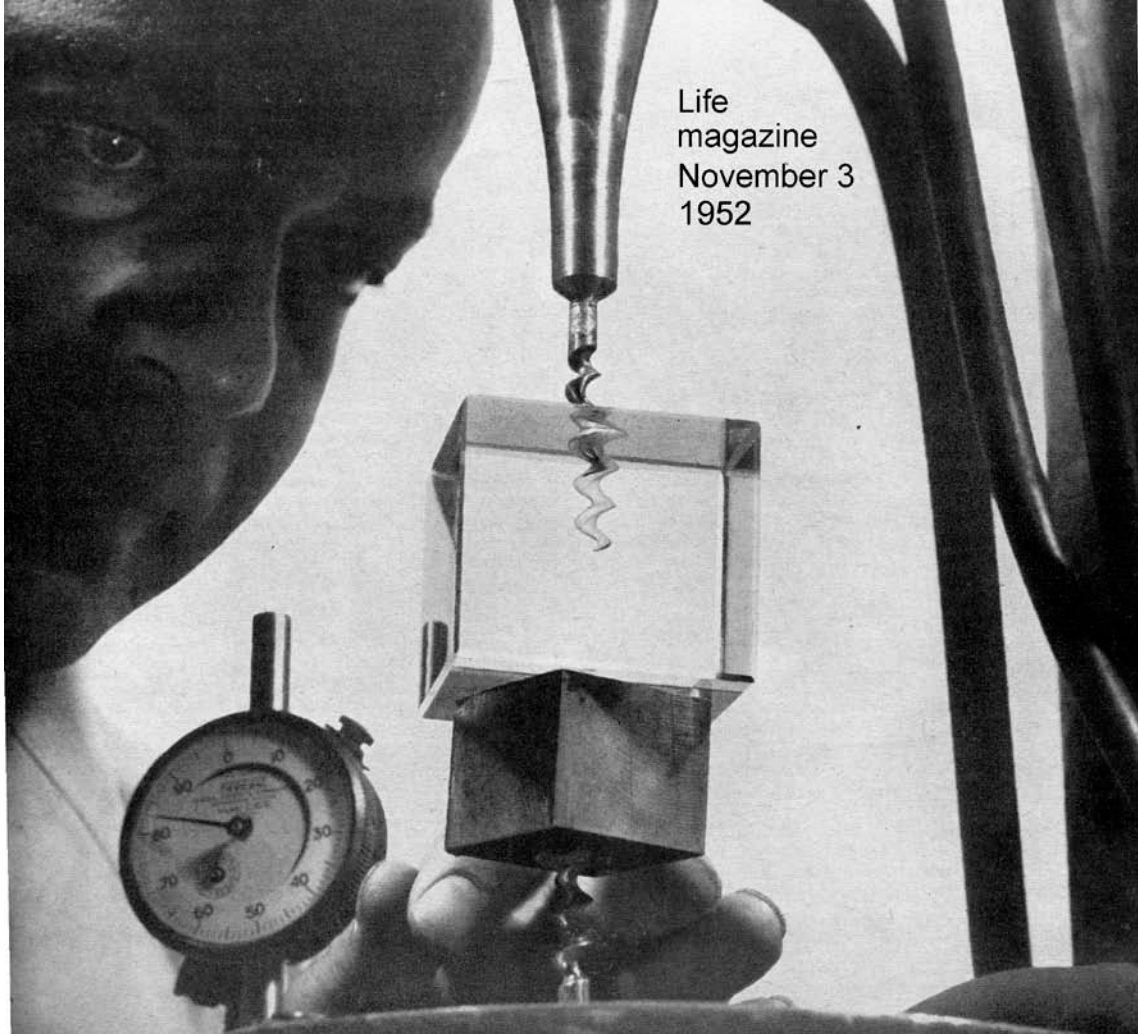
Cavitron/Kelman Phaco-Emsulsifier 1967



Integra CUSA
Ultrasonic
Surgical
Aspirator



Life
magazine
November 3
1952



DRILLING IN GLASS, a common corkscrew fastened to machine acts as a tool, makes neat twisting tunnel in the cube. Metal block supporting glass

cube is turned up off a duplicate corkscrew to push glass into upper corkscrew at right speed and angles. Hole would be almost impossible to drill with old methods.

ULTRASONIC CARVING MACHINE

Cavitron' uses high frequency vibrations to chisel out odd-shaped holes in hard-to-work materials

With the threat to increased U.S. arms production, the severe shortage of abrasive diamond dust needed to carve hard materials, may be relieved by an ingenious new application of ultrasonic waves. The Cavitron Corporation in Long Island City, N.Y. has developed a machine which uses ultrasonic vibrations and cheap abrasives to push soft tools through the hardest substances. The powerful high frequency vibrations make the tip of the steel cutting tool vibrate 27,000 times a second, driving it into a miniature trip hammer that pounds the abrasive against

the material and chips off microscopic flakes. The cutting tool can be blunt, flat, threaded or irregular in shape and thus the machine can cut holes which are impossible to make with conventional equipment (above).

Because it cuts more quickly and cheaply than conventional machine tools, the Cavitron is already being tried by companies that make aircraft parts, radio parts and delicately carved jewels. But its greatest effect on American industry may in time stem from the jobs which it alone can successfully do: carving intricate shapes in hitherto uncarvable materials.




RELATED LINKS

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- > [CNC Machining](#)
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- A nearly limitless number of feature shapes—including round, square, and odd-shaped thru-holes, and cavities of varying depths, as well as OD-ID features—can be machined with high quality and consistency.
- Features ranging in size from 0.008" up to several inches are possible in small workpieces, wafers, larger substrates, and material blanks.
- Aspect ratios as high as 25-to-1 are possible, depending on the material type and feature size. [View the ultrasonic machining 3D animation](#) to learn more about how ultrasonic machining works.

Ultrasonic machining is suitable for machining of hard, brittle materials including:

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Vibrations Replace Screwdriver

Ultrasonic Method Hammers Screws Into Solid Blocks

By **STACY V. JONES**
Special to The New York Times

WASHINGTON, April 30—Cavitron Ultrasonics, Inc., of New York, has developed a process capable of driving a toothpick into a solid block of plastic. More important for

Patents of the Week
Industrial purposes is its ability to insert screws without first drilling holes. The method, which

harnesses high-frequency vibrations to hammer pieces of metal into hard plastic bodies, was demonstrated at a recent packaging exposition in Chicago. As a result, Cavitron has received more than 50 inquiries on possible applications.

Patent 3,184,353 will be issued for the invention on May 18 to Dr. Lewis Balamuth, vice president of research and development, and Arthur Kuris, a former officer of the company.

In the process, ordinary house current is converted from 60 to 20,000 cycles per second. This in turn is converted by a vibrator into the same number of microscopically small mechanical strokes. Some pressure is applied simultaneously with the vibration.

The plastic flows around the object being inserted. If it is a screw, it is held tightly, but can be unscrewed and replaced in the ordinary way.

Dr. Balamuth said recently



Dr. Lewis Balamuth, vice president of Cavitron Ultrasonics, Inc., shows the concern's method of penetrating plastic.

that vibrational energy can induce a body to behave as if it had been heated, although the procedure is carried out at room temperature.

Possible uses, according to Cavitron, include inserting metal parts into plastic eyeglass frames and fastening electrical terminals to insulating boards. General hardware such as nameplates,

hinges, clamps and brackets can be securely attached to plastic bases.

The company has tested the method with a variety of materials, from polystyrene to nylon.

As a very small hammer can produce heavy blows in this way, one suggested use is in tool kits for space stations,

Continued on Page 45, Column 3

Ultrasonic
Staking and
Insertion.

Ultrasonic Staking Configurations

Ultrasonic staking, or riveting, is an assembly procedure used to join dissimilar materials, usually plastic to metal or dissimilar plastics. A hole in the metal part receives the plastic rivet, or stud, and a specially contoured horn contacts the stud. The stud melts and reforms to create a locking head over the metal.

As in any process involving localized heating by the dissipation of ultrasonic vibrations, an efficient system is necessary. The designer must control where and how fast a temperature rise will occur. Geometry plays an important role in determining the location of high strain which results in desirable localized heating, so an energy director is used in designs employing the ultrasonic staking technique. That is, the cross sectional area / height ratio of the material at the location where the initial dissipation is to occur is drastically reduced as compared to the adjacent segments which in this case are the body of the horn and the piece part containing the stud.

Two common designs are used to produce the needed geometry. The first (Flat Stud, see figures 1, 9) makes use of a point or line type contact by incorporating the joint design in the tip (or base) of the horn itself. The second technique (Pointed Stud, see figures 2, 10) calls for the energy director to be designed into the stud. The following lists examples and advantages of each variation to establish guidelines for the wide variety of possible applications.

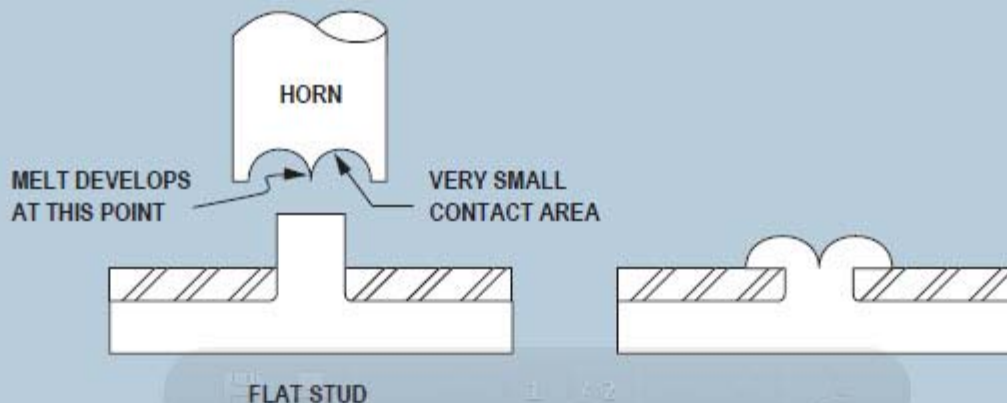


figure 1

Dec. 24, 1968

L. BALAMUTH ET AL.

3,418,185

Filed Aug. 3, 1965

METHOD AND APPARATUS FOR SPLICING MATERIALS

9 Sheets-Sheet 1

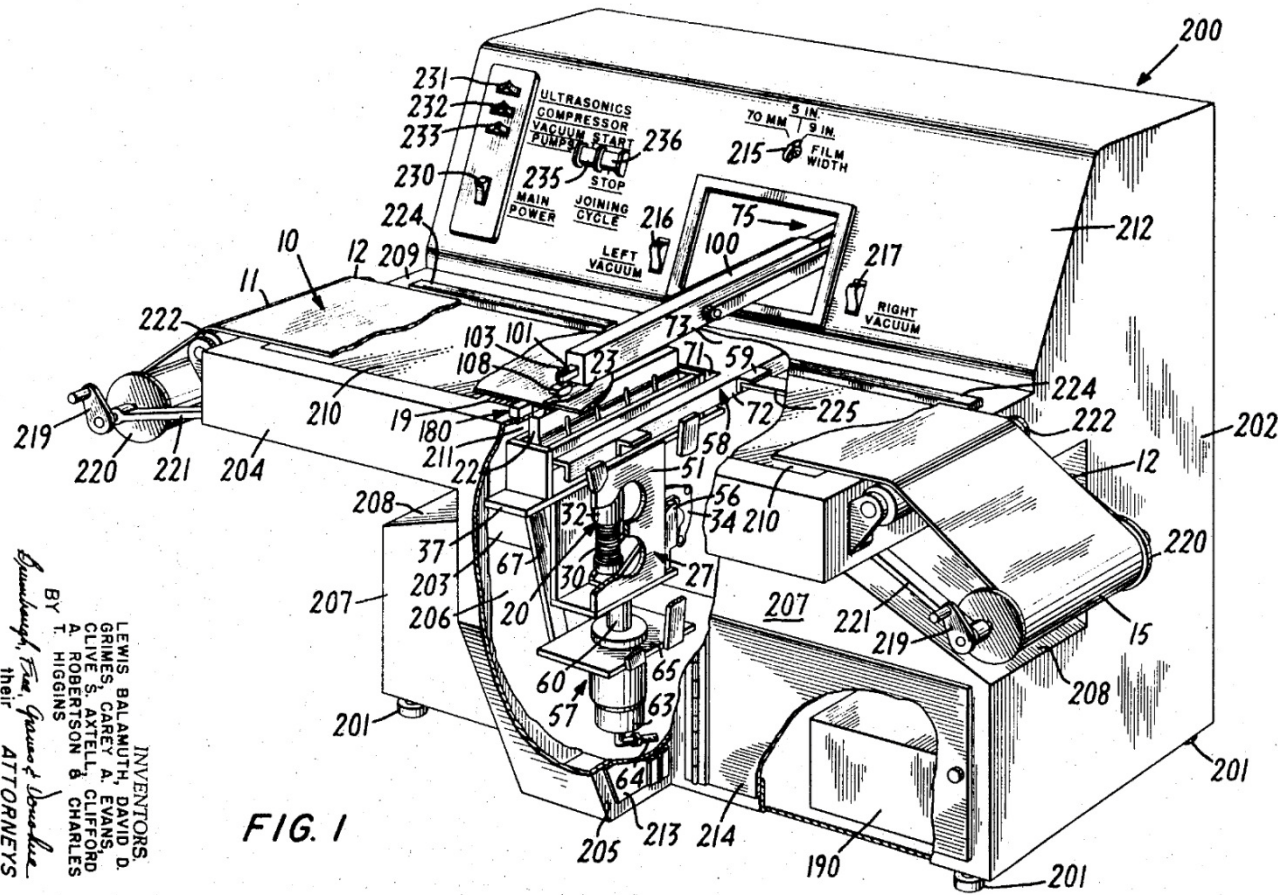
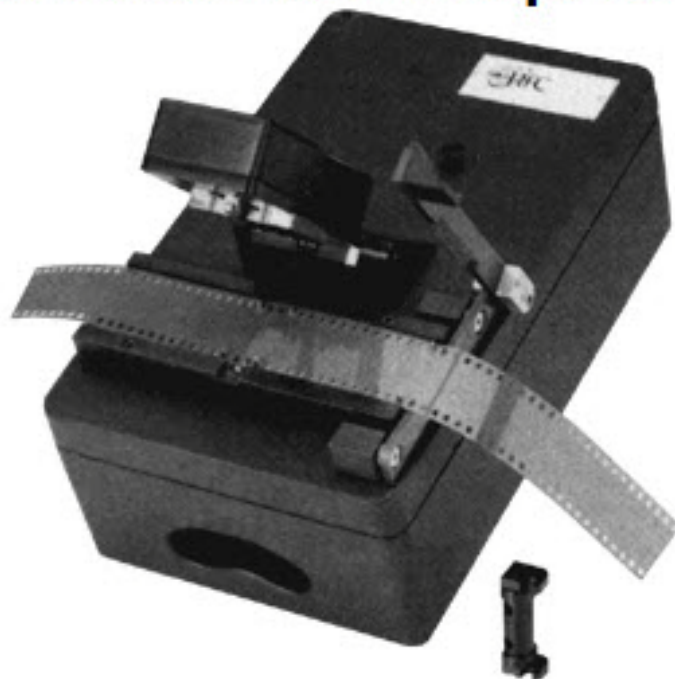


FIG. 1

Ultrasonic film splicing

INVENTORS:
LEWIS BALAMUTH, DAVID D.
GRIMES, CAREY A. EVANS,
CLINE S. AXTELL, CLIFFORD
A. ROBERTSON & CHARLES
T. HIGGINS
By *T. Higgins*
Spaulding, Fran, Gorman & Donnell
their ATTORNEYS

Ultrasonic Film Splicer



The HFC 2K ultrasonic film splicer makes splicing polyester film as easy as 1, 2, 3.

Ultrasonic film splicing can now be done professionally and easily, with minimum gap and maximum strength even at high speed.

The practical, compact design is user friendly. With few moving parts, the HFC 2K ultrasonic film splicer converts from one film format to another in just a few minutes.

35mm, 16mm, and negative precision pin register plates are available.

TX 89668

X 89656

(2)

Dec. 3, 1963

C. KLEESATTEL ETAL

3,113,225

ULTRASONIC VIBRATION GENERATOR

Filed June 9, 1960

3 Sheets-Sheet 1

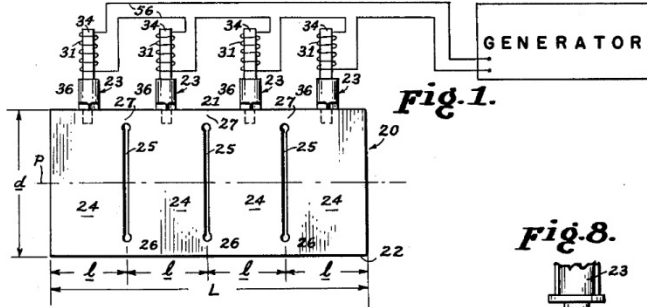


Fig. 1.

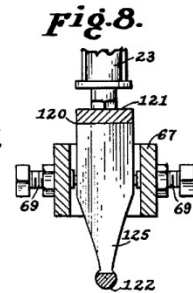


Fig. 8.

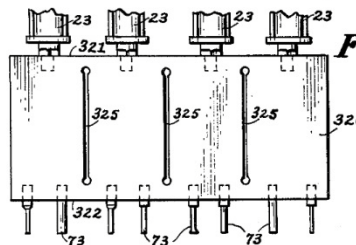


Fig. 5.

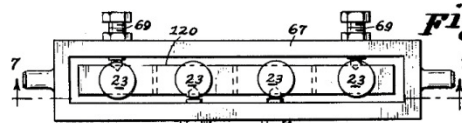


Fig. 6.

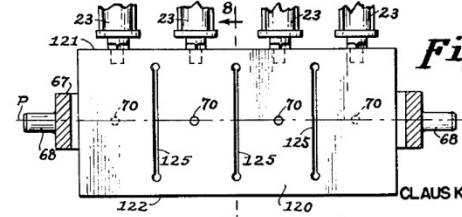


Fig. 7.

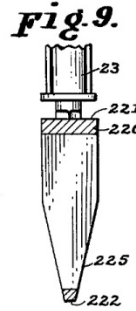


Fig. 9.

Slotted blade horn

INVENTORS
CLAUS KLEESATTEL LEWIS BALAMUTH
& ARTHUR KURIS
BY

ATTORNEY

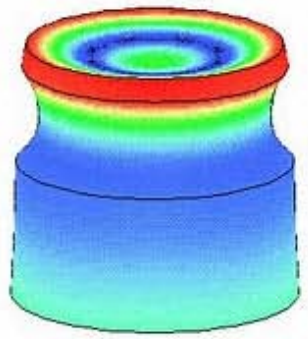
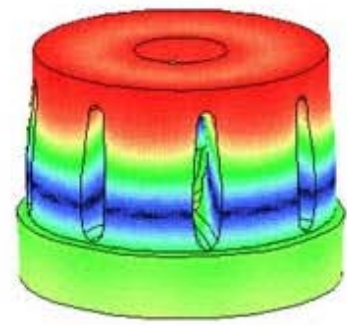
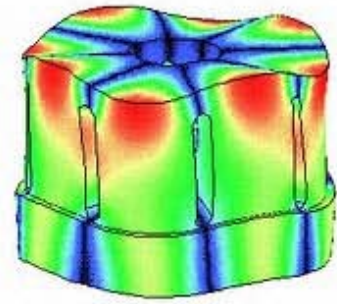
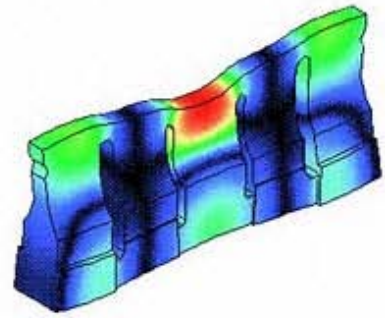
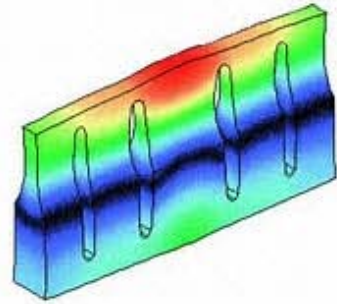
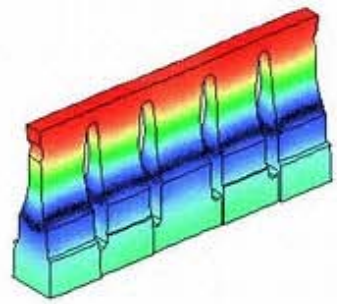
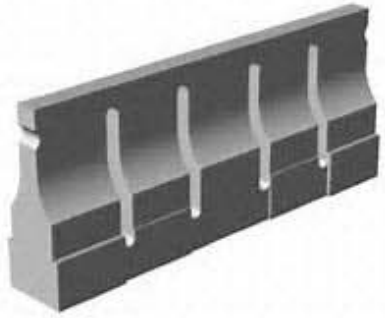


FIG. 11

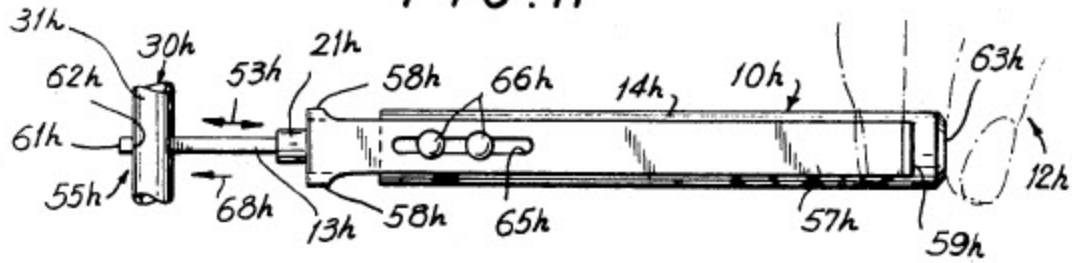


FIG. 10

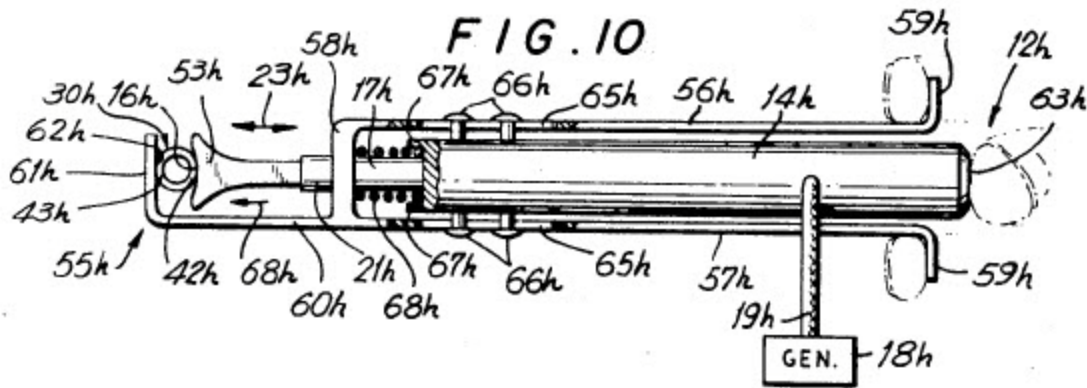


FIG. 12

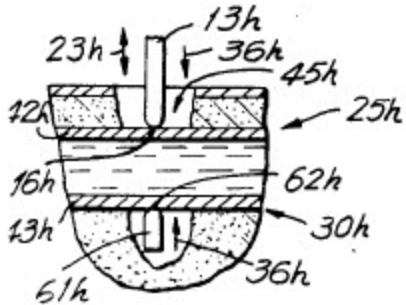


FIG. 12A

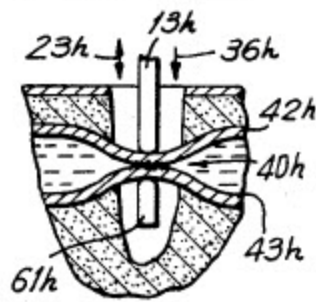
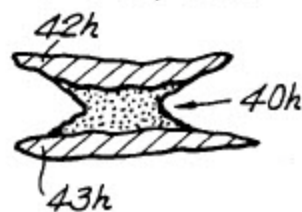


FIG. 12B



Ultrasonic cauterization

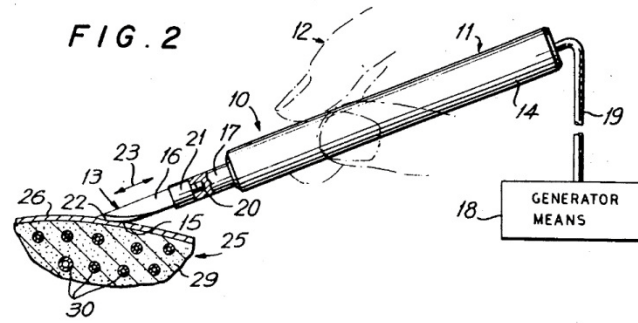


FIG. 4

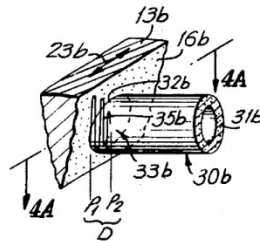


FIG. 4A

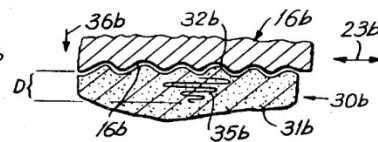


FIG. 4B

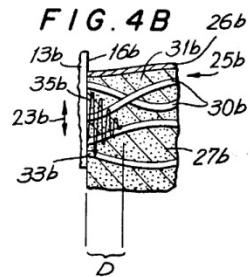


FIG. 4D

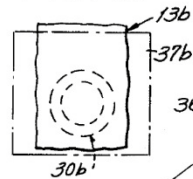
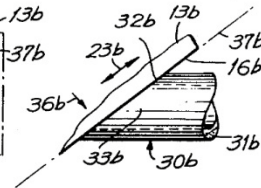


FIG. 4C



Ultrasonic surgical knife

Ultracision (Harmonic Scalpel)

The key procedures in endoscopic and open surgery are cutting and staunching blood. The **Harmonic Scalpel®** is able to perform both in one step using ultrasound technology. Even large vessels can be closed expeditiously and safely using this technique.

A special generator makes a scissors blade oscillate at a high frequency (55,000 Hz). The tissue gripped is heated to 50°C or even 100°C, which causes the blood vessel walls to stick together and to be sealed using a large protein plug.

Tissue preparation using the **UltraCision** technique is extremely precise. This allows the surgeon to perform operations with less risk and more gently. **Advantages** include effective staunching of blood while also reducing operating times. Patients recover quickly, allowing them to return to work and everyday life even sooner.



Oct. 20, 1964

C. KLEESATTEL

3,153,338

RESONANT SENSING DEVICES

Filed Nov. 22, 1961

2 Sheets-Sheet 1

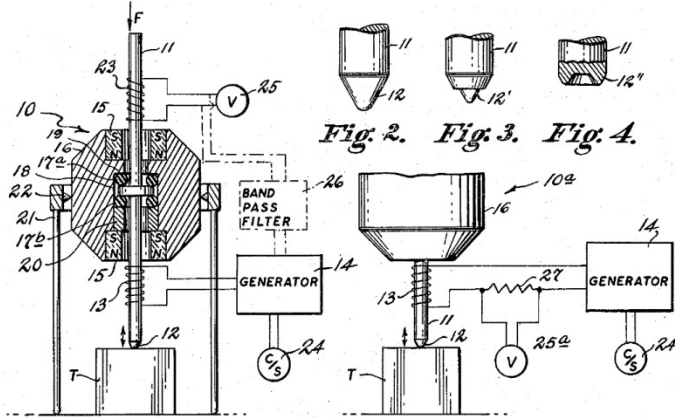


Fig. 1.

Fig. 5.

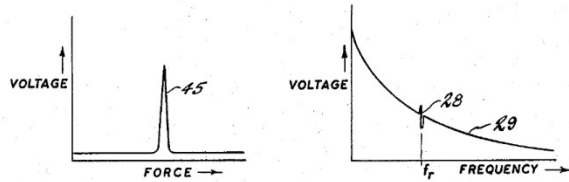


Fig. 8.

Fig. 6.

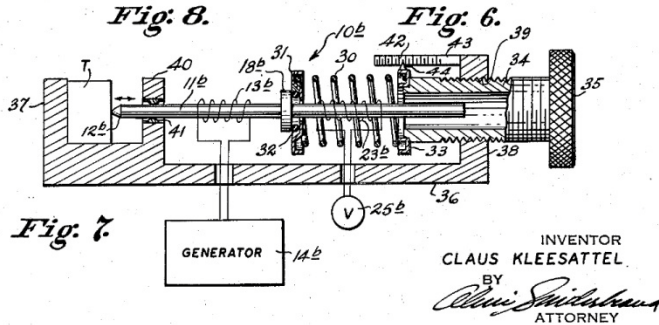


Fig. 7.

INVENTOR
 CLAUS KLEESATTEL
 BY *Claus Kleesattel*
 ATTORNEY

Ultrasonic Hardness tester

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Phase II MET-U1A Ultrasonic Hardness Tester



Print

Mfg# MET-U1A

Non-destructive hardness testing. Great for testing thin or small workpieces

Quantity: \$4,890.00

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[View manual](#)

Availability: In stock

Product Details

The PHASE II ultrasonic portable hardness testers are capable of measuring the surface hardness of a broad variety of metals on flat, round, thin or large surfaces. Unlike the standard Dynamic hardness testers, these "state-of-the-art" portable hardness testers incorporate "Ultrasonic UCI" technology, which enables the hardness testing of very thin and small workpieces, which otherwise could not be tested accurately using a portable device. Non-destructive in it's function, these hardness testers allow for the testing of highly sensitive or finished parts that previously could not be tested in an operational setting. The non-destructive (ndt) feature of these hardness testers allow the operator to accurately test parts without causing physical or structural damage that would normally lead to disposal or refinish of operators part. That translates into less scrap parts/ lower mfg costs due to necessary inspections.

PHASE II offers two models of ultrasonic hardness testers that are capable of measuring the surface hardness of a broad variety of metals on flat, round, thin or large surfaces. Accurate measurements of steel, cast steel, alloy steel, aluminum, brass, bronze and copper are easily attained with this compact instrument. The MET-U1A/ U1A50 meets **ASTM A1038-10** specifications.

Ultrasonic Contact Impedance is a hardness testing method based on the measurement of the frequency shift of a resonating rod caused by the essentially elastic nature of the finite area of contact between the indenter and the test piece during the penetration. Described as a hardness testing practice using a calibrated instrument by pressing a resonating rod with a Vickers style Diamond indenter with a fixed force against the surface of the part

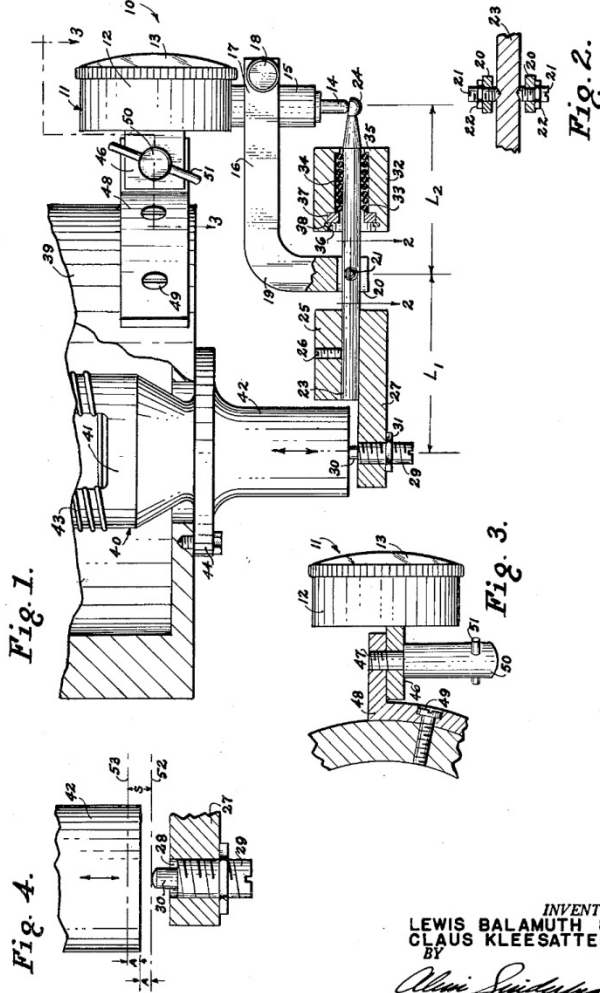
Aug. 7, 1962

L. BALAMUTH ET AL
AMPLITUDE INDICATORS

3,047,955

Filed Aug. 15, 1960

2 Sheets-Sheet 1



INVENTOR.
LEWIS BALAMUTH &
CLAUS KLEESATTEL
BY
Alvin S. Sander
ATTORNEY.

Dial indicator for measuring vibration amplitude

10 KHz – 200 KHz Amplitude Ultrasonic Testing Equipment , Ultrasonic Amplitude Measuring Instrument



10 KHz – 200 KHz Amplitude Ultrasonic Testing Equipment , Ultrasonic Amplitude Measuring Instrument

Country/Region	china
City & Province	anhui/fuyang
Company	Hangzhou Success Ultrasonic Equipment Co., Ltd
Categories	Ultrasonic Testing Equipment
Update	2014-08-18 09:04:39
Place of Origin:	Hangzhou, China
Brand Name:	FYCG
Certification:	BV
Model Number:	YP-0901B
Minimum Order Quantity:	1 Set
Packaging Details:	Wooden Case
Delivery Time:	5 Days
Payment Terms:	T/T Escrow
Supply Ability:	500 Sets/Month
Model:	YP-0901B
Range Of Frequency:	10 KHz – 200 KHz
Sensitivity:	1 μ m