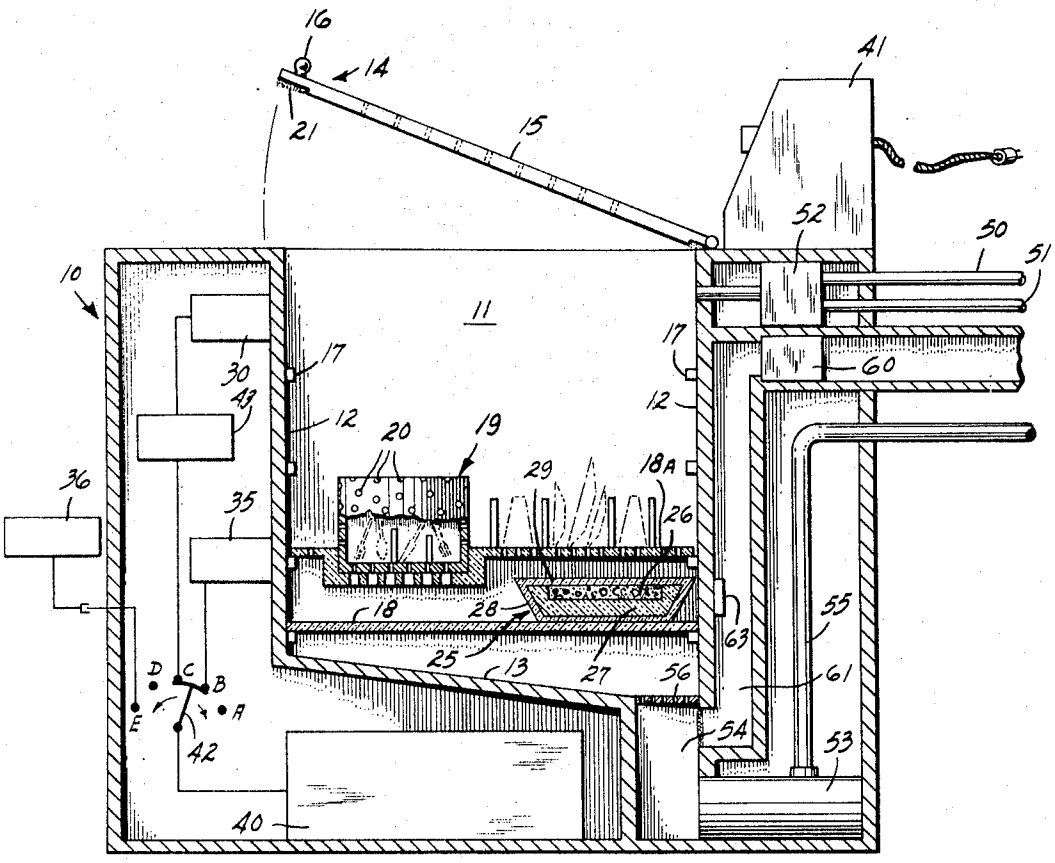
June 24, 1969 M. L. LEVINSON 3,451,401

MICROWAVE ULTRASONIC APPARATUS

Filed Oct. 12, 1967



INVENTOR
M. L. LEVINSON
By J. J. Lipari
ATTORNEY

United States Patent Office 3,451,401
Patented June 24, 1969

3,451,401

MICROWAVE ULTRASONIC APPARATUS

Melvin L. Levinson, 1 Meinzer St., Avenel, N.J. 07001

Continuation-in-part of application Ser. No. 492,183, Oct. 1, 1965. This application Oct. 12, 1967, Ser. No. 674,774

Int. Cl. B08 *3/10;* H05b *9/06*

U.S. Cl. 134—58 9 Claims

ABSTRACT OF THE DISCLOSURE

A multi-function apparatus capable of operating as an ultrasonic cleaner and microwave oven, which features the use of an ultrasonic emitting means, a microwave emitting means, and an implement capable of converting at least a portion of the emitting microwave energy into heat energy. The apparatus also features the use of circuitry capable of operating the ultrasonic and microwave emitting means either simultaneously or sequentially from a common power supply.

Cross references to related applications

This application is a continuation-in-part application of my copending application, U.S. Ser. No. 492,183, filed Oct. 1, 1965 and now abandoned.

This application also relates to my copending applications, U.S. Ser. Nos. 594,964, filed Oct. 24, 1966 and now Patent No. 3,410,116; 470,809, filed July 9, 1965 and now abandoned; 483,144, filed Aug. 27, 1965 and now abandoned; 497,851, filed Oct. 19, 1965; and 589,626, filed Oct. 26, 1966.

Background of the invention

This invention relates to microwave and ultrasonic apparatus, and particularly to a microwave-ultrasonic apparatus capable of performing numerous household and industrial functions.

In living areas where space is a premium, such as a mobile home, camping trailer, small apartment, small dwelling or the like, it is apparent that the numerous household items required for maintaining a household are space consuming and expensive. For example, it is most common to find a washer, dryer, dishwasher, oven, exhaust fan and the like in one's kitchen area. Also, even with commercial enterprises, such as hotels and restaurants, the aggregate cost of these items are high and the space occupied is great. As a result, single type apparatus have been invented which are capable of performing the function of a plurality of different appliances which include washers, dishwashers, driers, ovens and the like. A typical example of such single type apparatus having multi-functions may be found in my copending U.S. application, Ser. No. 594,964.

The above-discussed multi-function type apparatus employs microwave and ultrasonic energy in the utilities thereof. Accordingly, I have found it extremely desirable to provide such an apparatus having high efficiency and low cost. To this end, a unique microwave absorbing implement is employed with the microwave generator which causes it to operate at a relatively higher efficiency, thereby enhancing the utility of the apparatus. Further, the microwave generator is caused to operate from the ultrasonic power source, thereby reducing the bulk and cost associated therewith.

Summary of the invention

Accordingly, it is an object of this invention to provide a multi-function, microwave-ultrasonic type apparatus with an improved power and control structure.

It is another object of this invention to provide a multi-function type apparatus having an improved heating and loading unit utilized therein.

In general, the invention according to the objects, is a multi-function type apparatus capable of selectively functioning as a microwave oven and an ultrasonic cleaner, such as a washer or a dishwasher, and includes means for emitting microwave energy for heating a workload, means for emitting ultrasonic energy to said workload, means for selectively controlling the operation of said microwave and ultrasonic emitting means, and means responsive to the operation of the microwave emitting means for converting at least a part of the microwave energy to heat energy for heating the workload.

In one embodiment, the apparatus includes a work treating chamber having side and bottom wall surfaces adapted to retain treating liquid within said chamber, means in the chamber for supporting a workload to be treated therein, a microwave generator disposed in a portion of said chamber in such a position to expose said workload to a field of microwave energy, an ultrasonic transducer disposed in a portion of said chamber in such a position to subject a liquid in which the workload may be immersed to ultrasonic pulsations, closure means for the chamber, a microwave absorbing heating implement within said chamber, and means for energizing said microwave generator and ultrasonic transducer either simultaneously or sequentially.

Brief description of the drawing

The drawing is a cross-sectional view of the inventive apparatus with related circuitry.

Description of the preferred embodiment

Since this apparatus is capable of being utilized for many various functions, the apparatus will first be described generally and then in detail with respect to particular utilities thereof.

The apparatus includes a housing **10** having a work treating chamber **11** formed by side wall surfaces **12—12** and a slanted bottom surface **13**, said chamber **11** being adapted for retaining a liquid and microwave energy therein. A door **14** having an air intake window **15** and a handle **16** thereon is provided for access to the work chamber **11**. Supporting elements **17—17** are provided for holding various type removable shalves **18**, **18***a* thereon. A rim gasket **21** is provided on door **14** to prevent the escape of microwave energy from the chamber when the door is closed.

Shelves **18**, **18***a* may take various forms, e.g., one may take the form of a microwave oven shelf **18** or another may take the form of a dishwasher shelf **18***a* for holding dishes thereon. Shelves, generally, are made of material which is permeable to microwave energy and constructed as grids, grills or other conventional shapes transparent to water.

Shelf **18***a*, is transparent to water and microwave energy and is constructed so as to provide a removable, metallic grid enclosure **19** for holding articles, such as silverware and cutlery, which are subject to arcing when exposed to microwave energy. Openings **20—20** on the grid enclosure **19** are of any suitable size, e.g., approximately ⅛", which is sufficiently small to prevent microwave energy from passing therethrough (so as to prevent unwanted arcing throughout the silverware), but large enough for permitting fluids, ultrasonic energy and heat to pass therethrough. The metal grid enclosure **19** is located at a sufficient distance from walls **12—12** to prevent any unwanted arcing therewith.

A microwave-absorbing heating implement **25** may be utilized on a microwave oven shelf **18** or may even be in the form of a shelf per se (not shown). Numerous microwave-absorbing heating implements **25** are disclosed and

more fully described in my copending U.S. applications 470,809; 483,144; 497,851; 589,626. Briefly, the implement **25** includes a bed or layer **26** of particles of a resistive material, such as ferrite, supported on an insulating medium **27** which may be of a material such as GR 25, manufactured by General Refractories Company. Bed **26** and insulating medium **27** are encased in a microwave, permeable waterproof casing **28**, preferably made of a glass-ceramic type material such as Pyroceram (manufactured by Corning Glass Works) or Cer-Vit (manufactured by Owens-Illinois). The top portion of casing **28** is capable of use as a cooking surface **29**, described here and after. When a foodstuff or other work load is not present in chamber **11**, the ferrite bed **26** serves as a workload for a microwave emitter **30** such as a magnetron, and accordingly reflected microwave are substantially precluded, thereby preventing damage to the emitter. Said another way, upon energizing the microwave emitter **30**, the emitted microwaves contact the ferrite bed **26** which, in turn, transforms electrical energy into heat energy. In actuality, tiny electric arcs are initiated throughout the ferrite particles and within a very short time, the particle bed appears as if it was a glowing bed of coal emitting a high degree of heat. The heat generated is dependent on the amount and size of the ferrite particles, the quantity of the released microwave energy and time. As will be seen, when the apparatus is used as either a dishwasher or an oven, implement **25** will be useful.

A first transducer **35** is connected to the housing **10** and when energized, emits mechanical ultrasonic energy through the apparatus. As will be seen, the first transducer **35** will be of service when the apparatus is used as a dishwasher. A second transducer **36**, connected to a common power source **40**, is located external the housing **10** and functions as an accessory for other uses external the apparatus. For example, the second transducer **36** may be manually positioned in a washing container, such as a sink, for imparting mechanical ultrasonic pulsations to a cleaning fluid therein for cleaning utensils. Another use of the second transducer **36** may be for its quick connection to a scrub head which is utilized to effortlessly scrub floors or other hard surfaces. It should be understood that while two functions of the second transducer **36** have been recited, numerous other functions may be possible without departing from the spirit of this invention.

A conventional high wattage ultrasonic power source **40**, preferably a transistorized oscillator capable of emitting ultrasonic frequencies, is connected into a control circuit (not shown) operated by a programmer **41** which is selectively programmed to operate the apparatus for any one of its intended functions. Typical circuitry for operating the various control circuits may be found in my copending U.S. application, Ser. No. 594,964.

The high wattage, ultrasonic power source **40** is coupled to the first transducer **35** when the dual shorting contacts of switch **42** close contacts "A" and "B"; and to the second transducer **36** when the switch **42** closes contacts "D" and "E." When switch **42** closes contacts "C" and "D," power is supplied to the microwave emitter **30** via converter **43**. The microwave emitter **30** and first transducer **35** may be operated simultaneously when switch **42** closes contacts "B" and "C," thereby permitting one voltage to pass not only through contact "B" to the first transducer **35**, but also to pass through contact "C" to converter **43** which, in turn, transforms said voltage to a desired voltage necessary to operate microwave generator emitter **30**.

Converter **43** converts the output of the power source **40** into a suitable input for the microwave emitter **30**. Compared to a conventional 60 cycle power source, the high frequency output of the ultrasonic power source **40** provides a dramatic reduction in the physical size of the transformer and/or the condenser rectifier voltage multiplier circuits of converter **43**. As a result, the power supplies are shown in series rather than two individual 60 cycle parallel units.

The apparatus is further provided with inlets **50** and **51** for permitting the passage of hot and cold water into chamber **11** through valve **52**. Waste liquids are removed from the chamber by a pump **53**, located adjacent a drain cavity **54**, for withdrawal through tube **55**. A grid **56**, similar to the type utilized for the silverware enclosure **19**, is provided at the bottom of chamber **11** to not only negate the escape of microwave energy but also to permit liquid and forced air to pass therethrough.

When the chamber **11** is not filled with a liquid, a reversable type fan **60** and air tube **61** are provided for removal of steam from chamber **11**. More detailed use of fan **60** is described hereinafter when the apparatus is used as a dishwasher.

It should be noted that water inputs **50** and **51**, air exhaust tube **61** and drain tube **55** are illustrated and shown one above the other for ease in illustration. In practice they would be best found exiting and entering side by side at a level corresponding to input **50**.

Now that the apparatus has been described generally, further description will be directed to the use of the apparatus as a microwave oven and dishwasher.

Apparatus utilized as a microwave oven

With dishwasher shelf **18** removed from chamber **11**, a microwave oven shelf (not shown) is added on which is relocated implement **25**. The programmer **41** is set to operate a circuit (not shown) which causes switch **42** to move and close contacts "C" and "D," and power source **40** is energized. Converter **43** converts the output of the power source **40** to the desired voltage for the microwave emitter **30**. Microwave energy fills chamber **11** causing the ferrite bed **26** of implement **25** to transform the microwave energy into heat energy. By such action, implement **25** loads the microwave emitter **30**, thereby preventing any burn-out from reflected power. After the implement **25** is charged with heat, microwave emitter **30** is turned off and a desired foodstuff or workload is located on the implement, the workload being seared and browned as a result of the stored heat in the implement being released. The microwave emitter **30** is caused to again operate for the time desired to cook the workload. The implement **25** is then taken from chamber **11** to a remote location, whereupon the foodstuff may either be removed immediately from implement **25** or allowed to remain on implement **25** for further cooking, since heat continues to be released from the implement.

It should be noted that, while one cooking technique has been described, various other cooking techniques may be employed. For example, the implement **25** could be in the form of a cooking shelf, per se, and/or the workload could be placed on the implement without any preheating thereof. Further, two implements can be provided in opposing relationship to each other so as to cook the foodstuff from the top and bottom simultaneously in a manner similar to a sandwich grill.

Apparatus used as a dishwasher

After, shelf **18** and implement **25** are located in chamber **11**, dishwasher shelf **18***a* is positioned in the chamber whereupon dishes are placed thereon, and silverware and other objetcs subject to microwave arcing damage are place in protective grid enclosure **19**. The programmer **41** is set to operate a conventional dishwasher circuit (not shown), whereupon water is caused to flow into chamber **11** from inlets **50**, **51**. Switch **42** is caused to close contacts "A" and "B" to energize the ultrasonic transducer **35** which emits mechanical ultrasonic energy to ultrasonically clean the work and to emulsify any waste fats therefrom. Optionally, the switch **42** may be caused to move to close contacts "B" and "C," thereby energizing the transducer **35** and microwave generator **30** simultaneously so as to permit not only the emission

of ultrasonic energy into the chamber, but also the emission of microwave energy to impart additional heat to the water. After the work is cleansed and the waste fats are emulsified by ultransonics, the waste water is pumped by pump **53** from chamber **11** out through tube **55**. After a conventional rinse cycle, switch **42** closes contacts "C" and "D" so that only the microwave emitter **30** is energized to fill chamber **11** with microwave energy. It should be noted that the water on the work (dishes) serves as the primary source of the microwave emitter **30**'s load, thereby causing the work (dishes) to dry rapidly. As the quantity of water on the work becomes less and less, the internal arcing of the particle layer **26** becomes more and more prevalent, causing the implement **25** to take over as the primary load for the microwave emitter **30**. It can be seen that the ability of the heating implement **25** to convert microwave energy into heat energy as inversely proportional to the amount of water in chamber **11**.

During the drying of the work, fan **60** is operated to take out hot moist air from chamber **11**. This is accomplished by fan **60** drawing air through intake window **15**, chamber **11**, through grid enclosure **19**, drain caivity **54** and eventually out through exit tube **61**. As a result of the reduction of water in the chamber and a corresponding increase of arcing in implement **25**, a temperature rise is sensed by a heat sensor **63**, which causes the control circuit to open and deactivate the apparatus.

Although this invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention. For example, while a apparatus has been described as a microwave oven, dishwasher and accessory unit, other uses are readily apparent, such as those commonly asociated with ultrasonic units (e.g., medial applications, tenderizing meat and the like).

I calim:

1. A multi-function, microwave-ultrasonic apparatus, which comprises, means for emitting microwave energy to a workload, means for emitting ultrasonic energy to said workload, means for selectively controlling the operation of said microwave and ultrasonic emitting means, means responsive to the operation of the microwave emitting means for converting at least a part of the microwave energy to heat energy for heating the workload said responsive means comprising an implement having a bed of resistive particles having an insulating layer on one side of said bed of particles, and a removably located shelf for holding a first workload thereon capable of receiving microwave energy and a grid enclosure for holding a second workload therein, said enclosure being of such a grid size which is sufficiently small to prevent microwave energy from passing therethrough but sufficiently large to permit heat, liquid and ultrasonic energy to pass therethrough.

2. An apparatus, according to claim **1**, wherein the implement is further provided with a cooking surface located on the other side of the particle bed.

3. An apparatus, according to claim **1**, wherein the resistive particles are of a ferrite material.

4. An apparatus, according to claim **1**, which includes a second ultrasonic emitting means connected to the apparatus for use external of the apparatus.

5. An apparatus, according to claim **1**, which is capable of selectively opearting as an ultrasonic cleaner and a microwave oven.

6. An apparatus, according to claim **1**, wherein the selective controlling means includes a common power supply, a switch first, second, third and fourth contacts for said switch, and means for energizing the power supply and activating the switch whereupon a closing of the first and second contacts energize the ultrasonic emitting means, a closing of the second and third contacts energize the ultrasonic and microwave emitting means simultaneously, and a closing of the third and fourth contacts energize the microwave emitting means solely.

7. An apparatus, according to claim **6**, wherein a first voltage is emitted from the power supply, and wherein a converter is provided for converting the first voltage of the power supply to a second voltage for energization of the microwave emitting means.

8. An apparatus, according to claim **6**, which includes a fifth contact and a second ultrasonic emitting means capable of use external of the apparatus, said second ultrasonic emitting means being energized upon a closing of the fourth and fifth contacts by the switch.

9. A multifunction apparatus, which comprises, a work treating chamber having side and bottom wall surfaces adapted to retain treating liquid within said chamber, means in the chamber for supporting a workload to be treated therein, a microwave generator disposed in a portion of said chamber in such a position to expose said workload to a field of microwave energy, a first ultrasonic transducer disposed in a portion of said chamber in such a position to subject a liquid in which the workload may be immersed to ultrasonic energy, a second ultrasonic emitting means connected to the apparatus for use external of the apparatus, closure means for the chamber, a microwave absorbing heating implement within said chamber, having an insulating layer on one side and a cooking surafce on the other side means for energizing said microwave generator and ultrasonic transducer either simultaneously or sequentially, means for permitting the flow of liquid into the chamber, means for withdrawing waste liquid from said chamber, and means for withdrawing generated hot, moist air from said chamber.

References Cited

UNITED STATES PATENTS

1,671,557	5N1928	Tyler	134—58 XR
2,216,388	10/1940	Hampel	134—58 XR
2,985,003	5/1961	Gelfand et al.	68—3
3,184,400	5/1965	Magnus	204—193
3,329,529	7/1967	Lamar	134—58
3,410,116	11/1968	Levinson	68—3

OTHER REFERENCES

German printed application Serial No. 1,120,619, Dec. 28, 1961, Homann.

ROBERT L. BLEUTGE, *Primary Examiner.*

U.S. Cl. X.R.

68—3; 134—1, 105, 115, 184; 219—10.55

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,451,401 Dated June 24, 1969

Inventor(s) MELVIN L. LEVINSON

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 39, replace "medial" with --medical--.

SIGNED AND
SEALED

DEC 2 - 1969

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents