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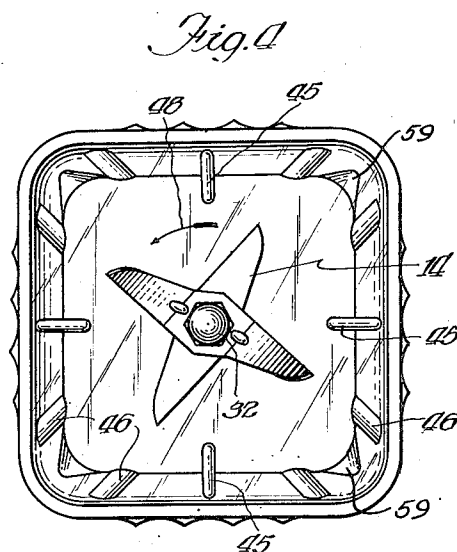
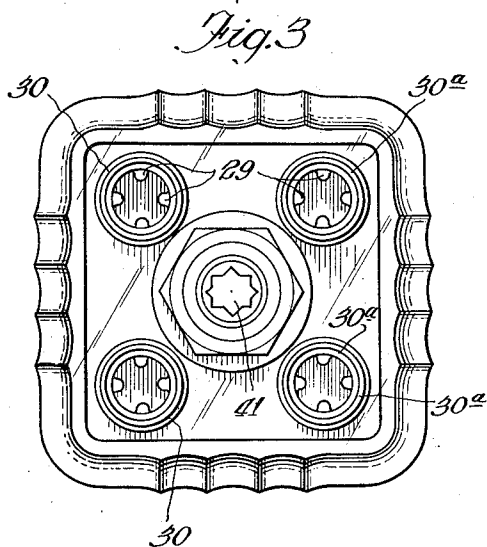
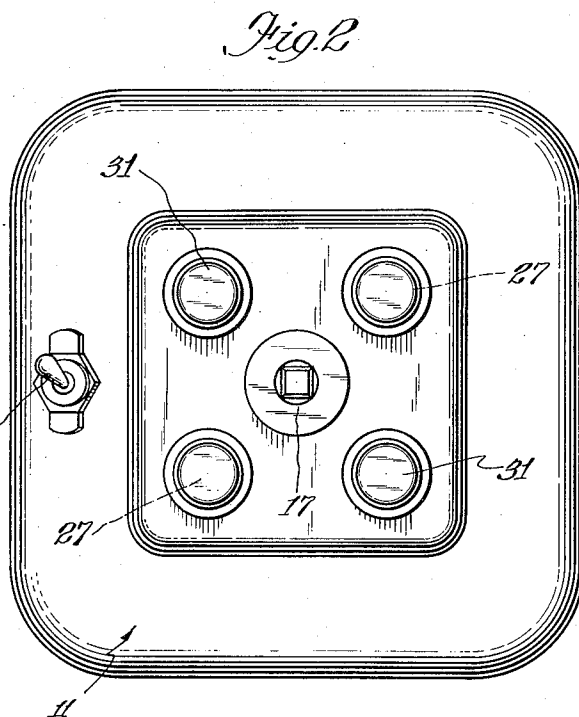
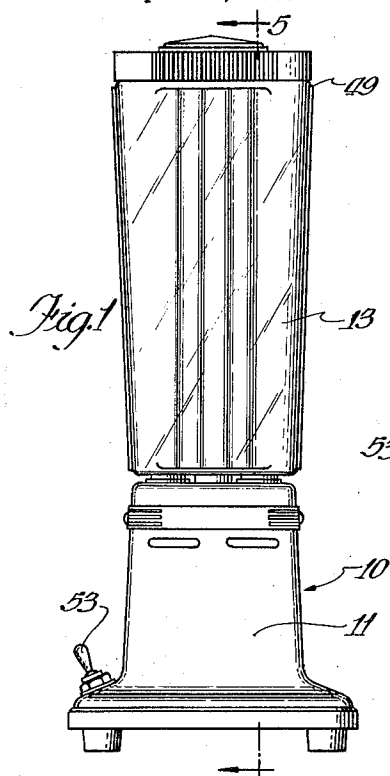
N. MALZ ET AL

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LIQUIFIER HAVING RESILIENTLY MOUNTED MOTOR AND CONTAINER

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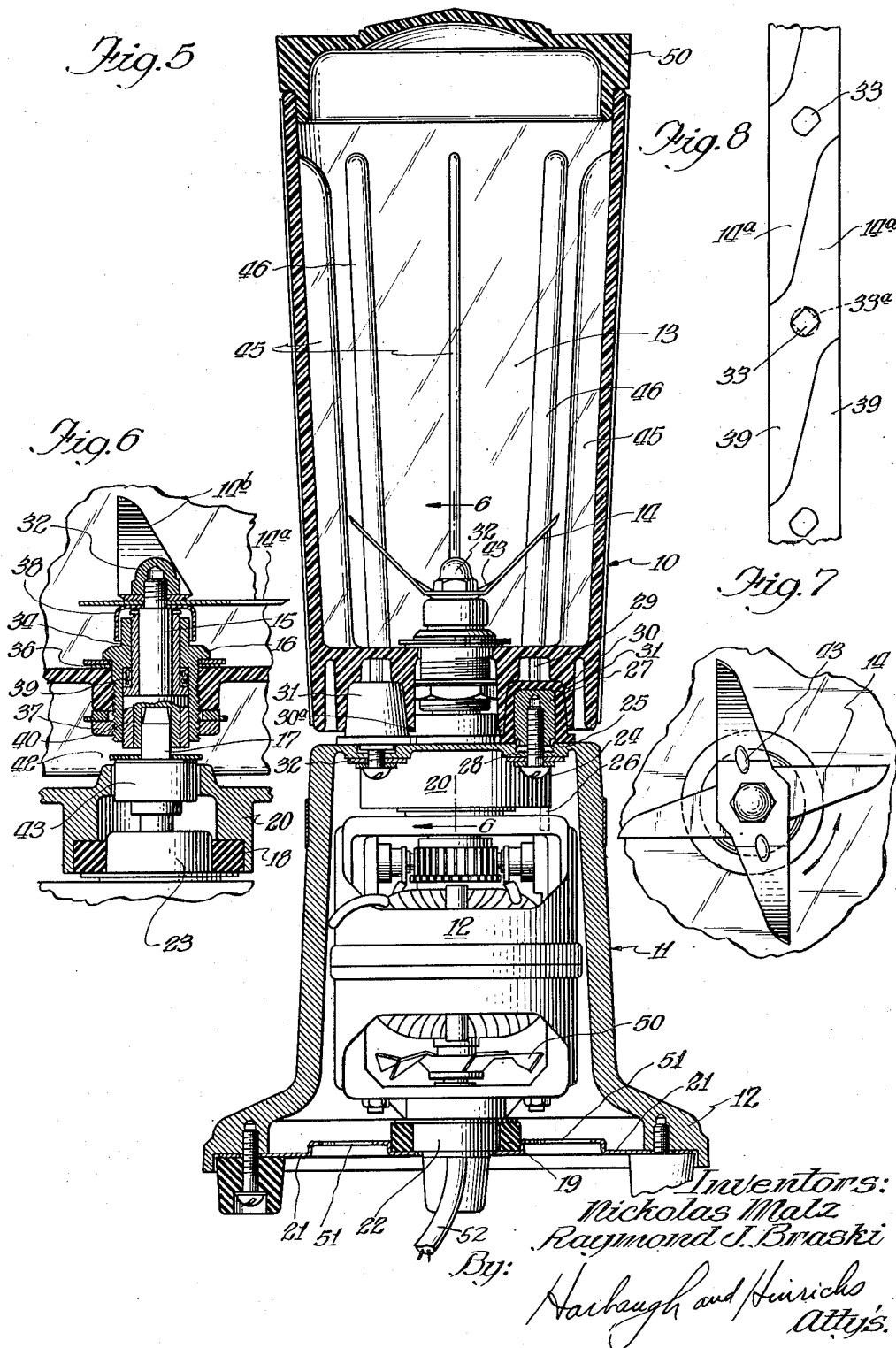


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LIQUIFIER HAVING RESILIENTLY MOUNTED MOTOR AND CONTAINER

2 Sheets-Sheet 2



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LIQUIFIER HAVING RESILIENTLY MOUNTED MOTOR AND CONTAINER

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6 Claims. (Cl. 146—68)

The present invention relates generally to liquifiers of the type which act upon mixtures of liquids and solids to form liquid mixtures, the devices having whirling blades or knives which not only agitate and aerate the mixtures, but also serve to cut up the solid particles to reduce them to very small sizes capable of being suspended in the mixture.

The device of this invention is intended primarily for use in the preparation of foods and beverages and it may be used to perform a variety of operations depending upon the manner in which it is operated and the substances involved. For example it may be used to mix and aerate two different liquids, to form a suspension of a liquid in a solid either with or without aeration, or to simply render certain solids as liquid suspensions. Thus the liquifier may be used to convert vegetables or fruits into juices, to make soups, to make shakes of ice cream and liquids or to chop up ice into fine particles for cocktails and other beverages.

Liquifiers have been produced heretofore, but the prior devices have been difficult to operate in that they are or were hard to keep clean, likely to tip over or spill the contents during or after mixing, and were excessively noisy in operation and inefficient in cutting and agitating. Moreover mountings heretofore employed are difficult to release when wedged and tightened under vibrations of the device or are so loose that secondary vibrations are set up which deteriorate the device rapidly. Not only this, but the mountings of containers upon the motors heretofore have been such that the cutting and agitation space in the bottom of the container has been greatly curtailed and the mounting area is quite narrow. Other containers are also likely to scar table tops or the like when set upon them.

One important object of this invention is to provide a liquifier in which these defects are eliminated, the device being efficient and quiet in operation and unlikely to tip due to reactive forces in starting the device as well as free from the possibility of throwing liquid out of the container during the comminuting action, particularly when filled to a depth approaching capacity.

Another object is to provide a liquifier which may be operated without alteration or change of parts either with aeration or without aeration of the mixture and in which the container and cutter blades cooperate to provide a slicing rather than a shattering action.

A further object is to provide a cutter blade which has improved mixing and cutting action and which is very simple to fabricate, sharpen and keep sharp.

Another object is to provide an improved arrangement for mounting the mixing container whereby the container is movable with the motor as a unit, is restrained by the base to such a degree as to result in a minimum of wobbling, and accomplishes full alignment with the motor at all times.

The invention is further characterized by a container construction which eliminates vortexing of the mixture when the container is filled above a predetermined level.

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The invention is also characterized by a self-tightening and self-aligning mounting between the motor and the container which absorbs vibration between them yet is readily released merely by lifting the container.

Other objects and advantages of the liquifier of this invention will present themselves to those familiar with the art on reading the following specification in conjunction with the drawings and the appended claims.

In the drawings:

Fig. 1 is a side elevation of a preferred form of a liquifier embodying the invention;

Fig. 2 is an enlarged top plan view of the motor unit with the container removed;

Fig. 3 is an enlarged bottom plan view of the container;

Fig. 4 is an enlarged top plan view of the container;

Fig. 5 is an enlarged vertical section through the liquifier, taken on line 5—5 of Fig. 1.

Fig. 6 is an enlarged vertical section taken on line 6—6 of Fig. 5;

Fig. 7 is an enlarged top plan view of the agitator-cutter; and

Fig. 8 is a plan view showing the manner in which the cutter blades are formed economically from a strip of metal.

The liquifier 10 of this invention comprises a base 11, having an electric motor 12 therein, and a container 13 substantially square in sectional contour and made of a light plastic such as cellulose acetate, is removably supported on top of the base. Cutting blades 14 carried on a drive shaft 15 journaled in a bushing 16 are mounted in the bottom of the container. The shaft 15 is removably coupled to the motor shaft 17 in drive relationship. Thus the container 13 and the cutter assembly may be lifted from off the base 11 when desired either to pour the mix or to store the liquifier in a more compact space. In fact the container can be inverted and stored on the top of the base, the mouth being wide enough to receive the top of the base to the depth determined by lands described hereinafter.

The base 11 is preferably formed from a unitary hollow die casting having a flaring lower portion 12 and an open bottom. The sectional shape of the base is generally square with rounded corners to conform to the mixing container 13. The electric motor 12 is axially supported by a pair of elastomer mounting rings 18 and 19 (Figs. 5 and 6 respectively), which are carried by the base 11. Although shown as circular rings, either one or both may be square to prevent relative rotation between the motor and housing as well as cushion counter torque loads. The upper ring 18 is received in a recess provided in a boss 20 which projects downwardly from the top wall of the base while the lower ring 19 is carried in a corresponding recess in a perforated closure plate 21 which closes the bottom of the base. If a circular ring is used a resilient projection 26 is provided to prevent relative rotation between motor and housing under counter torque load condition. The projection is formed as a part of the boss 20 and has a resilient sleeve on it to dampen vibration. Thus the motor 12 is mounted in a fixed vertical position against substantial endwise or sidewise motion, and has been found to be quite satisfactory in that the motor 12 is free to move somewhat under reactive load forces, yet is restrained in such fashion that vibration is not set up. This results in very quiet operation.

To support the container 13 in proper operative alignment with the motor 12, four hollow bosses 30 are provided on the bottom of the container. These bosses receive nuts 27 covered with an elastomer 31 which are secured to the top of the base 11 by bolts 32 located in circular openings 25 provided in bosses 28 at the four corners of the top of the base.

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To insure self-alignment and good supporting contact between the elastomer covered nuts 27 and the container 13, the elastomer elements 31 are frusto-conical in shape to mate with the correspondingly shaped openings in the bosses 30. At the inner ends of the openings in the bosses 30, lands 29 are provided which serve as stops for limiting the depth to which the elastomer elements 31 are received in the openings. The ends of the elements 31 and lands bear most of the weight of the container and contacts and are so arranged that they determine the level support of the container. However, the mating tapered walls of the studs and openings are permitted to telescope just enough to engage firmly without wedging, thereby maintaining an engagement which is readily released merely by lifting the container. In this connection it is interesting to note that the lands maintain a space filled with air which prevents any vacuum forming that might obstruct separation when the container is being removed from the motor housing. A reaming out of the edge at 30a around the mouth of the opening 30 at an angle of 45° assists in guiding the studs into place.

Thus the container 13 is supported in such fashion that it is movable with the motor, yet is restrained by tapered elastomer elements 31. This has been found to maintain a superior operative alignment between the motor and the container because each stud is a complete alignment unit and all the studs serve collectively to align and support the parts over a wide support area not only during the liquifying operation, but the support can be easily established and maintained when placing the device in operation and can be easily disengaged after the operation is stopped. Moreover, should the rotating cutters 14 strike a substantially solid particle such as a piece of ice and transmit a reactive force back down to the motor, both the motor and container are free to move or float with each other within resilient limits to maintain alignment and quiet operation.

The above described semi-floating arrangement has been found to be far superior to the conventional full floating arrangement where the container rests loosely on the motor alone. The reason for this is that when both the motor and the container are not held resiliently together as a unit, but are loosely movable with respect to each other, periodical oscillations are likely to be set up of such a magnitude that wave-like portions of the mixture are thrown out of the container and in extreme cases may cause the unit to upset, particularly where a container is made of a light plastic instead of a heavy body of glass.

The cutter blades 14 are rigidly supported on the upper end of the shaft 15 by an acorn nut 32. To secure the blades against turning with respect to the shaft 15, the sides of the shaft are machined flat and the blades are provided with flat sided mating holes 33, as shown in Fig. 8. The shaft 15 in turn is journaled in a sleeve bearing 34 press fitted in the bushing 16 with a lubricant saturated wick 39 behind it, and the assembly is received in an opening in the bottom of the container 13. To prevent leakage, an elastomer gasket 36 is provided in the upper end of the bushing 16, the gasket being compressed by the action of a nut 37 which is threaded on the bottom of the bushing. To prevent leakage along the shaft 15 a close fit is maintained between the bearing 34 and the shaft 15 and in addition to this hydrostatic pressure of the liquid on the bearing is removed during operation of the device by a bell or cup 38 provided beneath the blades 14 which projects downwardly over the top of the bushing 16. This bell turns with the blades 14 and centrifugates the liquid. Moreover, the cup 38 serves exactly as a diving bell to enclose a pocket of air at the upper end of the bearing under resting conditions to keep as much as possible of the liquid from contacting the bearing. Furthermore, the shaft is preferably made of stainless steel and the bearing of brass to eliminate rust and corrosion.

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To hold the cutter assembly against axial movement, a shoulder 40 (Fig. 6) is provided on the shaft 15 at the lower end of the bearing surface. This shoulder prevents upward movement of the assembly while the cup 38 and blades 14 prevent downward movement. The lower end of the shaft 15 is provided with an eight-pointed star-shaped opening 41. This opening receives the square end of the motor shaft 17 (Fig. 2) in any one of eight different positions when the container is supported on the base. Not only is the end of the shaft tapered so as to guide the square corners of the shaft into the nearest point of the star with a minimum of effort, but the shaft 17 is embedded in a full floating resilient drive member 43 to align itself in both engagement and drive relationship.

To prevent liquid from leaking into the motor, a disk 42 is provided on the motor shaft 17 at the point where it projects above the base 11. This disk 42 rotates with the motor shaft and sheds onto the base any liquid which might be applied to clean the motor or is accidentally spilled.

The novel beater blade arrangement is significant from a manufacturing as well as a mixing and liquifying standpoint. In working out this economy of production, the product provided in conjunction with the bowl several unexpected results as will be explained later.

The cutters 14 are preferably shaped as shown so that they may be stamped from continuous strips of cutlery stainless steel as shown in Fig. 8, with virtually no waste. With this arrangement both sides of the strip before stamping are ground or swaged and ground to sharp edges as indicated at 39. The blades on the lower cutter are shorter than those in the upper cutter but both are of the same general contour. In grinding, the strip is simply passed over grinding wheels set at a small angle with respect to the strip. After the blades 14 are stamped to the shape shown in Fig. 8. The upper cutter is die formed to the third dimensional shape shown in Figs. 5 and 6 in which the cutting ends slant upwardly at about 45°. The reversely upset portions indicated at 43 are provided to increase the strength of the blades at the bends.

Only the lower blades 14a are shown in Fig. 8. It is to be understood, however, that the upper blades 14b are fabricated from a strip in the same manner except that the cutting ends are made somewhat longer in the upper blades.

One other difference between the cutters is the disposition of the flat sides in the center hole. One relative position is shown in full lines 33 and the relative position for the other cutter is shown in broken lines 33a. This enables the cutters to be disposed at right angles to each other when assembled.

By way of understanding the operation of the cutters it will be noted on examination of Fig. 7 that the cutting edges of the blades 14 are set at an angle of about twenty degrees to radii drawn through the midpoints of the cutting edges. Because of this angular relationship the blades exert a slicing action as they engage solid particles in the mix as augmented by the outward movement which is imparted to the particles by centrifugal force as they are rotated by the blades. This is particularly important in the liquification of fibrous substances such as fruits or vegetables which cannot be cut readily without slicing.

On close examination of the drawings it will be noted that the cutting edges of the blades are beveled on the lower sides. This causes the mix to be drawn downwardly and outwardly by the cutter assembly making it unnecessary to pitch the blades. Moreover, the effect of the bevel is to increase the whirlpooling action in the mix and draw more air down into the mix thereby increasing the degree of aeration possible over that which would result with blades which were sharpened only on top or top and bottom.

Referring now to the mixing container 13, it is sub-

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stantially square in section as already mentioned and diverges slightly outwardly, the top being somewhat larger than the bottom for molding purposes and the bottom members also being provided with adequate molding draft with the parting line just below the top as indicated at 49 (Fig. 1). In addition to cellulose acetate the container can be made of methacrylate so as to be virtually unbreakable, and it is preferred that the material be transparent so that the mix may be observed even when the cover 50 is in place. Actually the cover is not required for most mixing operations, but it is preferred so that with some mixtures, particularly in small quantities, material will not be splattered out of the container.

The inside of the container 13 is provided with four major ribs 45 (Fig. 4) which extend one on each side of the container substantially the full length of the container. Eight minor ribs 46 are provided intermediate the major ribs and the corners of the container. The function of the four major ribs in their broad concept is to counteract the whirlpooling action of the mix enough to prevent the mix from climbing the sides of the container above approximately the half way mark. By the time the mix goes that high on the walls, the major ribs have established a brake sufficiently strong to have the rising mix fall inwardly into the center. The secondary ribs assist in slowing down secondary whirlpooling which might develop in each of the four corners.

Under the intense action of the beaters, whirlpooling of a desirable violence will occur at and slightly above the beater level, but above this the whirlpooling action is quickly arrested so that the mix, particularly if present in a small quantity, is quickly returned to the blades to accelerate the recurrence of blade contact above that conventionally present where much of the liquid is spread upwardly on the sides of the container for longer periods of time.

This construction of the container and ribs in combination with the cutters accomplishes several unexpected results. In the first place all conventional liquefiers aerate the mix regardless of the amount of liquid in the container. In the present invention, if the starting amount of liquid in the container is above the half full mark there will be no aeration of the mixture. Thus aeration when undesirable can be eliminated by starting with a large amount of liquid. On the other hand if aeration is desired in a large amount of liquid it can be aerated by starting with a small amount of liquid and adding to it until the full amount is present.

Furthermore whether or not the liquid is being aerated or mixed without aeration, the container can be filled almost to the top without spilling.

When aerating, the motor, being a series wound motor, runs faster than when aeration is not present and this may assist in the desirable result of liquifying without aeration when desired, particularly when the device is used for laboratory work as well as culinary operations. However the speed with which liquefaction is accomplished is not slowed nor are unliquefied particles prone to collect on top of the mix with or without aeration.

Otherwise it is obvious that the invention provides a very rugged container which can withstand long and hard use even to cutting up ice cubes without danger of strains or operations breaking or shattering the container.

By way of example and not by way of limiting the invention it has been found that a container having the following dimensions are particularly capable of the results mentioned, to wit, with a container 8" high and 4" square at the top, minor ribs 46, which are 6" long and about $\frac{5}{16}$ " high have been quite satisfactory, the rest of the device being in proportion as shown upon the drawings.

As shown in Fig. 4, tapered fillets 59 about 2" high are provided in the corners to assist in cleaning, and although the bottom wall of the container could be made to be removable from the side walls for purposes of ease in

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cleaning it has been found that this is unnecessary with the construction as shown and avoids leaking joints and the danger that the blades might be run some time without the sidewalls serving as guards.

The motor 12 is constructed to have an open frame as shown in Fig. 5, and a fan 50 is provided on the lower end of the armature, the fan blades being pitched to cause a flow of air upwardly through the motor. Thus the air flows upwardly through the motor and downwardly around the outside of the frame in continuous circulation, cool air being drawn in through perforations 51 provided in the plate 21 which closes the bottom of the base 11. The electric current is supplied to the motor through a conventional cord set indicated at 52 connected through a switch 53 mounted in the flaring portion 12 of the base 11.

From the foregoing it will be appreciated that a very superior liquefier has been provided, which is not only easier to operate but also performs functions and accomplishes results not performed by prior devices as set forth in the objects and description. Accordingly various changes or modifications such as will present themselves to those familiar with the art may be made without departing from the spirit of this invention, the scope of which is commensurate with the following claims.

What is claimed is:

1. A device of the class described comprising a mixing container having cutter blades therein rotatable about a vertical axis and having a plurality of recesses in the bottom wall opening downwardly equal distances from said axis, a base for supporting said container, an electric motor within said base having a vertical armature shaft projecting upwardly through the top of said base for rotation about a predetermined axis, a pair of resilient rings carried by said base concentric with the last said axis for axially supporting the ends of said motor in weight bearing and vibration dampening relationship, a plurality of studs carried by said base and projecting upwardly from the top of said base at equal distances from said axis of the armature shaft, a resilient supporting means on each of said studs engaging in said recesses for supporting the container, said resilient supporting means having coplanar upper end walls engaging the bottom of said recesses to bear most of the weight of the container and having upwardly tapering side walls for guiding the walls of said recesses into mating relationship therewith to align said vertical axes.

2. A device of the class described comprising a mixing container having cutter blades therein rotatable about a predetermined axis and a plurality of hollow bosses on the bottom thereof providing downwardly opening frusto-conical openings at the upper ends of which lands are provided which serve as weight-bearing stops, a base for supporting said container, an electric motor within said base having a vertical armature shaft projecting upwardly through the top of said base for rotation about a predetermined axis, resilient means for supporting said motor against axial and lateral motion, a plurality of frusto-conical elastomer elements projecting upwardly from the top of said base at equal distances from the second-mentioned axis, said elastomer elements mating with said openings and having coplanar tops engaging said lands for limiting the depth to which the elastomer elements are received in said openings.

3. A device of the class described comprising a mixing container having cutter blades therein rotatable about a vertical axis, a hollow boss on the bottom of the container with downwardly diverging side walls defining frusto-conical surfaces equidistant from said axis and terminating in coplanar shoulders at one end of the surfaces, a base for supporting said container, an electric motor mounted in the base and having a powder shaft projecting upwardly through the top of said base rotatable about a vertical axis, a plurality of upstanding elements hav-

ing elastomer coverings thereon defining frusto-conical surfaces equidistant from the second-mentioned axis and mating with the first-mentioned frusto-conical surfaces for bringing said axes in alignment with each other when the container is received on said base, said elements having coplanar portions at one end of the second-mentioned frusto-conical surfaces for engaging said shoulders in weight bearing level relationship.

4. The combination called for in claim 3 in which the electric motor mounting includes a pair of resilient rings for supporting said motor, one ring at the upper end of the motor and the other at the lower end, said base having a downwardly opening cavity at its upper end with a shoulder at the upper end of the cavity for receiving the upper ring, a shoulder on the electric motor engaging the lower face of the upper ring, and means carried by the bottom of the base for engaging the lower ring to bring the shoulder on the base and the shoulder on the motor into firm contact on opposite sides of the upper ring, and means for preventing relative rotation between the motor and the casing.

5. The combination called for in claim 3 in which the shaft of said motor is embedded in an enlarged cylindrical resilient member and the base has a cylindrical wall proximate to the enlarged portion, the resilient member carrying a drive member for said cutter blades and being of such size as to engage the cylindrical wall to slow down the motor in case of excessive vibration.

6. In a liquifier of the type having a relatively deep mixing container superposed above a power unit with a cutter assembly in the bottom thereof rotatable about a predetermined axis, the combination including a base for supporting the container, an electric motor having a

vertical drive shaft housed within said base for rotation about a predetermined axis, a plurality of frusto-conical resilient container supporting elements on the top of said base receivable in guided telescoping relationship with corresponding conical sockets provided on the bottom of said container, weight bearing means for limiting the telescoping relationship between said elements and sockets, and resilient means for supporting said motor in said base against axial displacement.

References Cited in the file of this patent

UNITED STATES PATENTS

354,572	Norton	Dec. 21, 1886
535,566	Waterson	Mar. 12, 1895
763,962	Clayton et al.	July 5, 1904
1,480,914	Poplawski	Jan. 15, 1924
1,779,147	Richardson	Oct. 21, 1930
1,850,199	Bryant	Mar. 22, 1932
1,916,192	David	July 4, 1933
1,927,184	Poplawski	Sept. 19, 1933
2,156,421	Austria	May 2, 1939
2,284,155	Landgraf	May 26, 1942
2,304,476	Poplawski	Dec. 8, 1942
2,315,018	Lawrence	Mar. 30, 1943
2,328,526	Grove et al.	Aug. 31, 1943
2,386,503	Presslley	Oct. 9, 1945
2,483,295	Mortimer	Sept. 27, 1949
2,576,802	Morris	Nov. 27, 1951
2,585,255	Kochner et al.	Feb. 12, 1952

FOREIGN PATENTS

817,438	France	May 24, 1937
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