

Nov. 2, 1965

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3,215,409

MIXER

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2 Sheets-Sheet 1

FIG. 1

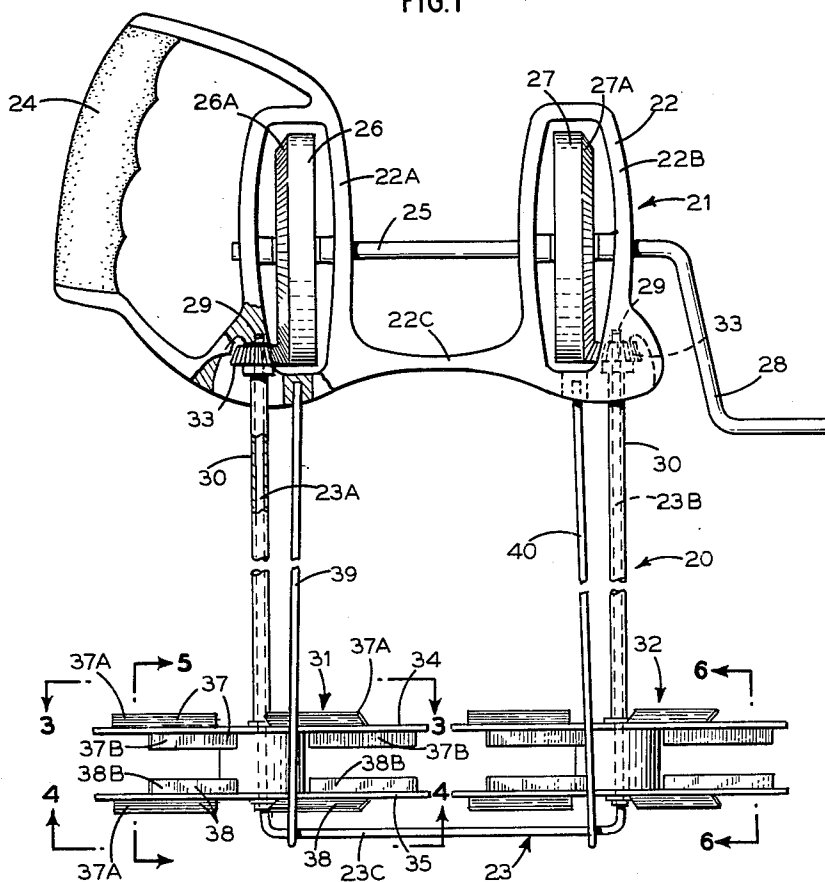


FIG. 3

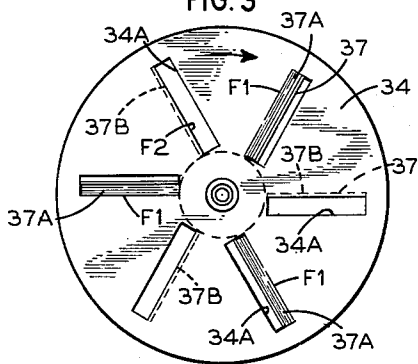
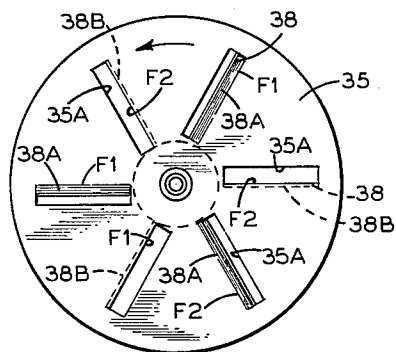


FIG. 4



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2 Sheets-Sheet 2

FIG. 2

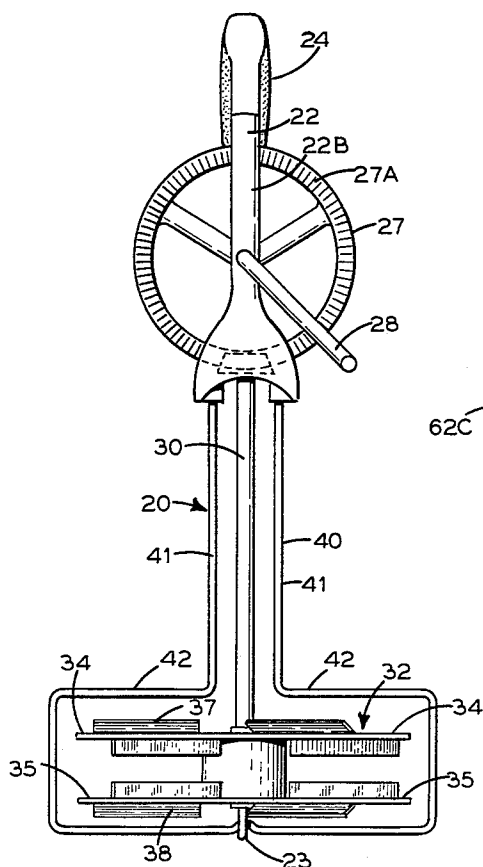


FIG. 8

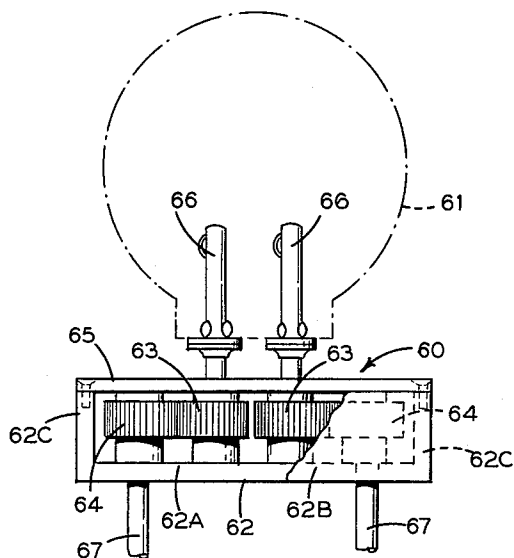


FIG. 9

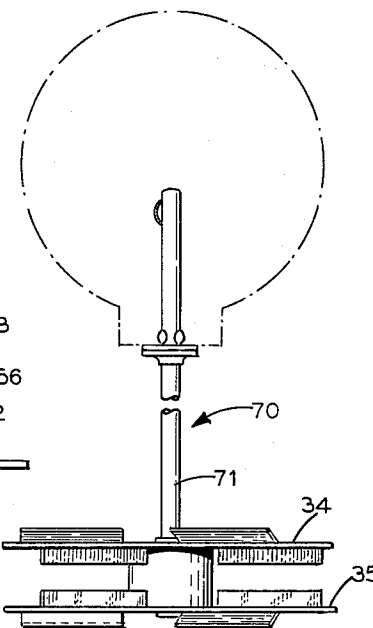


FIG. 5

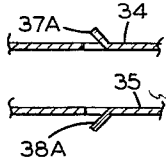


FIG. 6

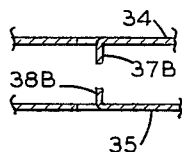
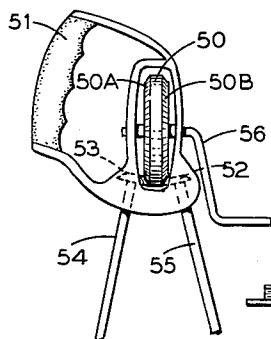


FIG. 7



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1

3,215,409
MIXER

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13 Claims. (Cl. 259-131)

This invention relates in general to a mixer, and more specifically to a centrifugal mixer and improved mixing head therefor.

An object of this invention is to provide an improved centrifugal mixer and mixing head therefor for effecting a rapid and intense mixing action.

Another object is to provide a mixing head constructed and arranged so as to render the same readily adaptable for use with conventional household electrical mixers.

Another object of this invention is to provide a centrifugal mixer and mixing head therefor constructed and arranged for manual or hand operation.

Another object of this invention is to provide an improved mixing head constructed and arranged so as to exert a compressive force on the fluid being mixed so as to further enhance the mixing action.

It is another object of this invention to provide a centrifugal mixer capable of satisfactorily performing all types of mixing or blending operations.

Still another object of this invention is to provide an improved mixing head construction constructed so as to effect a mechanical and hydraulic shear of the fluid during a mixing operation to effect a rapid and intense mixing action.

Still another object of this invention is to provide an improved mixer and mixing head therefor that is relatively simple in construction, inexpensive to fabricate, and positive in operation.

The above objects and other features and advantages are attained by a centrifugal mixer comprising essentially of a drive means operatively associated with a mixing head specifically constructed and arranged to effect a rapid and intense mixing action with a minimum of effort. In accordance with this invention, the mixer may be constructed and arranged so as to utilize either one or more mixing heads. Each of the mixing heads comprises essentially of a pair of spaced plate members or discs journaled to a shaft. Each of the plates or discs is provided with a series of radially extending slots. Co-operatively associated with each of the slots is a vane means which is bent out of the plane of its respective plate or disc. For optimum operation, the slots of the respective pair of discs of the mixing head are disposed in axial alignment. In accordance with this invention the vanes of each disc are alternately bent to either side of the respective discs. The vanes bent to the outer side of the respective discs are inclined in the direction of rotation of the disc to define an acute angle with respect to the plane of the disc. The inwardly directed vanes are disposed substantially normal to the respective plates thereof.

For optimum performance, two such mixing heads are connected to a drive means so as to be counter-rotated with respect to one another. The arrangement is such that in operation the respective heads effect an intense mechanical and hydraulic shearing action on the fluid being mixed during a mixing operation.

In one form of the invention, the respective mixing heads are constructed and arranged as an adaptor assembly for applying the same to the drive connections of a conventional power operated mixer. In another form of the invention the mixing heads are incorporated in a manual or hand driven means.

A feature of this invention resides in the provision that the respective discs of the mixing head can be economically fabricated as by stamping.

2

Another feature of this invention resides in the provision that each of the discs making up the mixing head are substantially similar in construction.

Another feature of this invention resides in the provision that the respective mixing heads are constructed and arranged so as to effect an intimate mixing of the fluid to be mixed.

Other features and advantages will become more readily apparent when considered in view of the specification and drawings in which,

FIGURE 1 is a front elevation view of a mixer of the instant invention.

FIGURE 2 is a right end view of the mixer of FIG. 1.

FIGURE 3 is a detail top plan view of the mixing head taken along line 3-3 of FIG. 1.

FIGURE 4 is a detail bottom plan view taken along line 4-4 of FIG. 1.

FIGURE 5 is a section view taken through the mixing head along line 5-5 of FIG. 1.

FIGURE 6 is a section view taken through the mixing head along line 6-6 of FIG. 1.

FIGURE 7 illustrates a fragmentary front elevation view of a slightly modified form of the invention.

FIGURE 8 is a front elevation view of another modified form of the invention and,

FIGURE 9 is a front elevation view of still another form of the invention.

Referring to the drawings, there is shown the mixers and mixing head therefor constructed in accordance with this invention. In the embodiment illustrated of FIGS. 1 to 6, the mixer 20 comprises essentially of a frame 21 including an upper frame portion 22 and a lower wire frame portion 23. The upper frame portion 22 is preferably defined by a pair of spaced yoke portions 22A, 22B interconnected by a web portion 22C which can be suitably formed by a casting. Connected integrally with one of the yoke portions 22A is a handle means 24 by which the mixer may be grasped. Rotatably journaled between the outer side portions of the respective yoke portions 22A, 22B and extending therethrough is a shaft 25. A pair of drive wheels 26, 27 are connected in spaced relationship on the shaft 25, each of the drive wheels being journaled on the shaft 25 within their respective yoke portions 22A, 22B. A crank 28 is integrally connected to one end of the shaft 25 and it provides the means whereby the drive wheels 26, 27 may be rotated.

The lower frame portion 23 includes a U shaped wire frame member having opposed leg portions 23A, 23B and an interconnected bight portion 23C. The respective frame portions 22 and 23 are secured by having the upper ends of the respective leg portions 22A, 23B of the lower wire frame portion fitted into sockets 29 defined in the bottom of each of the respective yoke portions 22A, 22B.

Rotatably journaled about each of the leg portions 23A, 23B of the lower wire frame portion is a hollow shaft 30 to which the respective mixing heads 31, 32 are secured.

As shown, a bevel gear 33 is connected to the upper end of each of the respective shafts 30. Accordingly each bevel gear 33 is arranged so as to be in meshing relationship with a gear track 26A, 27A formed in the side edge portion of the adjacent drive wheel.

Connected to the lower end of the respective hollow shafts is the mixing head construction of this invention. It is to be noted that each of the mixing head constructions 31, 32 are similar in construction, but opposite in hand. Therefore, the description of one is considered sufficient for an understanding of the invention.

The respective mixing heads each comprise a pair of spaced flat plates or discs 34, 35. A plurality of radially extending slots 34A, 35A are formed in each of the re-

3

spective discs 34, 35 making up the mixing head. Operatively associated with each of the respective slots 34A, 35A is a vane 37, 38. In accordance with this invention, the vanes 37, 38 are formed by the portion of the material that is blanked out from the plane to the respective discs to define the slots formed therein. As best seen in view 3 and 4, the vanes associated with each of the slots in both the upper and lower discs of the mixing head are bent out of the plane of their respective discs along a fold line F1, F2, defined by the trailing edge of the respective slots. In accordance with this invention, alternate vanes 37A, 38A are bent outwardly of their respective discs. The vanes 37A, 38A define an acute angle with respect to the plane of their respective discs and they are inclined in direction of rotation of the disc. The vanes 37B, 38B associated with the other slots are angularly bent inwardly toward one another, and as best seen in FIG. 6, the inwardly directed vanes 37B, 38B of the upper and lower disc members are disposed substantially normal relative to the plane of their respective discs. For optimum operation the slots 34A, 35A formed in the upper and lower discs 34, 35 of the respective mixing heads are co-axially disposed.

As shown in FIGS. 1 and 2 and 5, the inwardly directed vanes are constructed and arranged so the respective free ends there are spaced in vertical alignment one from the other.

Completing the mixer assembly, are a pair of auxiliary lower wire frame members 39, 40 which extend transversely to the U shaped wire frame member. As best seen in FIG. 2, each of the auxiliary frame members comprise upright leg portions 41 connected to a laterally off-set portion 42 for accommodating the width of the mixing head. Thus the lower offset portion 42 of the auxiliary frame members define a cage for the respective mixing head.

In operation, it is to be noted that rotation of the crank 28 will cause the respective drive wheels 26, 27 to counter-rotate the respective mixing head geared thereto. Therefore, since the outwardly extended vanes 37A, 38A of the respective heads are inclined in the respective direction of rotation of the disc, they will serve to forcibly direct the fluid being mixed through the slots 34A, 35A formed adjacent thereto to the space defined between spaced plates. The inwardly directed vanes 37B, 38B in turn discharge the fluid from the space between plates in a radially outward direction. In doing so, portions of the fluid are compressed by the spacing between the inwardly extending vanes 37B, 38B. Also, as the respective mixing heads 31 and 32 are counter-rotating with respect to each other, fluid is discharged radially outwardly from between the plates of the respective mixing heads to result in hydraulic shearing of the fluid due to portions of the fluid being directed toward each other. As a result, a rapid and intense mixing of the fluid is attained. The vanes impinging on the fluid also effects a mechanical shear to further enhance the mixing operation.

FIGURE 7 illustrates a modified form of the invention. In this form of the invention, the structure of the mixing head is identical with that hereinbefore described. This form of the invention differs however from that of the form described with reference to FIGS. 1 to 6 in that a single drive wheel 50 is utilized for driving each of the respective mixing heads in counter-rotation with respect to one another. This is attained by forming the handle frame portion 51 of the mixer with a single yoke for accommodating, but a single drive wheel, therefore, in this form of the invention, both side edges of the drive wheel is provided with a gear track 50A, 50B. The bevel gears 52, 53 connected to each of the respective mixer shafts 54, 55 are thus disposed in meshing relationship with the opposite sides 50A, 50B of the single drive wheel

4

50. Consequently, it will be apparent that when the crank 56 is rotated, the single drive wheel 50 will cause the respective bevel gears 52, 53 disposed in engagement with the respective sides thereof to counter-rotate the shafts and respective mixing heads connected thereto to attain a mixing action similar to that hereinabove described.

FIGURE 8 illustrates how the mixing heads described can be constructed as an adaptor 60 for use with the drive means 61 of a conventional power operated mixer, e.g. electric domestic type mixer. In this form of the invention, the adaptor 60 for positioning the mixing heads, similar in construction as described with reference to FIG. 1, to the drive means 61 of a domestic electric mixer or the like comprises a gear housing 62 in which there is rotatably journaled therein a pair of drive gears 63. Each of the drive gears 63 are disposed in meshing relationship respectively with a driven gear 64 also rotatably journaled within the housing 62. Preferably the housing 62 is constructed as a box arrangement having a bottom wall 62A and enclosing front, rear and end walls 62B, 62C, 62D. A removably connected cover plate 65 is provided to close the upper end of the housing 62.

Extending upwardly through the cover plate 65 of the housing are a pair of drive shafts 66 which are fixedly connected to the respective drive gears 63. The shafts 67 to which the respective mixing heads are connected are each connected to the driven gears 64 and they extend downwardly through the bottom plate 62A of the housing. Accordingly the spacing between centers of the drive shafts 66 is such that they can be readily adapted for insertion into the drive sockets of a power operated mixer 61. In operation, the mixing action afforded by the adaptor 60 is similar to that herein described, with the exception that the mixing heads are power operated, as distinguished from the manual operation described with reference to FIGS. 1 to 7.

FIGURE 9 is an arrangement illustrating the use of a single mixing head attachment 70 for an electrical appliance. In this form of the invention, the mixing head comprises simply of the drive shaft 71 and the spaced plates 34 and 35 similar to that hereinbefore described connected thereto. Thus drive shaft 71 can be directly detachably connected into the drive socket of a power operated mixer.

From the foregoing, it will be readily apparent that the described mixers and mixing head therefor is relatively simple in construction, can be easily fabricated and is positive in operation. The arrangement of the specific mixing head is such that a violent and rapid intermingling of the fluid or substance being mixed is readily attained in a minimum of time and with a minimum of effort. The arrangement is such that the mixing action is enhanced due to the mechanical and hydraulic shearing effect which the respective mixing head has on the substance being mixed when the mixing head is submerged below the level thereof. It is to be noted that the operation mixing head is such that the outwardly bent vanes in the respective upper and lower discs of the mixing head forcibly direct fluid through the slots associated therewith to the space defined therebetween, and that the inwardly directed vanes of the alternately disposed slots serve to effect shearing of the fluid being mixed as well as a compression thereof. Thus the particles of the substances are intimately mixed or blended together. The counter-rotating of the respective mixing heads further force the fluids being ejected from the space between the respective mixing heads to be directed toward one another to impart hydraulic shear thereto. Because of the arrangement described, a rapid mixing is attained and for this reason, the time required to otherwise mix or blend various substances in a manner heretofore known is greatly enhanced.

5

While the instant invention has been described with reference to several embodiments thereof, it is to be noted that variations and modifications thereof may be made without departing from the spirit or scope of this invention.

What is claimed is:

1. A mixing device comprising,
 - (a) a frame including,
 - (b) a drive means,
 - (c) a mixing head mounted for rotation on said frame connected in driving relationship with said drive means,
 - (d) said mixing head including a pair of spaced flat plate members,
 - (e) each of said plate members having a plurality of circumferentially spaced radially extending slots therein, the corresponding slots of said respective plates being disposed in axial alignment,
 - (f) a vane operatively associated with each of said slots,
 - (g) the vanes of said slots in each of said plates being bent outwardly and inwardly to extend to either side of their respective plates, and
 - (h) the vanes bent outwardly of their respective plates being inclined at an acute angle to the plane of their respective plate members in the direction of rotation of said head,
 - (i) and the vanes bent inwardly of the respective plates being disposed substantially normal to the plane of their respective plates.
2. The invention as defined in claim 1 wherein,
 - (a) the inwardly bent vanes of said plates have their respective free edges spaced from one another.
3. A mixing device comprising,
 - (a) a shaft adapted to be rotated,
 - (b) a mixing head connected to said shaft,
 - (c) said mixing head including a pair of spaced flat plate members,
 - (d) each of said plate members including a plurality of radially extending slots formed therein, each of said slots having a leading edge and a trailing edge,
 - (e) an imperforate vane operatively associated with each of said slots,
 - (f) each of said vanes being bent out of the plane of its respective plate members along the trailing edge of its corresponding slot,
 - (g) and the alternate vanes on each of said plates being directed to either side of the plane of their respective plate member so that the outwardly disposed vane of the respective plate members are opposed one another and the inwardly disposed vanes are disposed in spaced relationship opposite one another, the outwardly disposed vanes being inclined at an acute angle to the plane of their respective plate members, and the inwardly disposed vanes being disposed substantially normal to the plane of their respective plate members.
4. A mixing device comprising,
 - (a) a pair of spaced apart shafts adapted to be mounted for counter-rotation with respect to one another,
 - (b) a mixing head connected to each of said shafts to rotate therewith,
 - (c) each of said mixing heads including a pair of spaced plate members,
 - (d) the respective plate members including a plurality of radially extending slots formed therein, each of said slots having a leading edge and a trailing edge,
 - (e) an imperforate vane operatively associated with each of said slots,
 - (f) each of said vanes being bent out of the plane of its respective plate along the trailing edge of each slot,
 - (g) and the alternate vanes of the respective head plates being oppositely directed to either side thereof so that the outwardly disposed vanes of the re-

6

spective heads are opposed one another and are inclined in the direction of rotation at an acute angle relative to the plane of the respective plate members and the inwardly disposed vanes are disposed opposite one another and are disposed substantially normal to the plane of its respective plate members.

5. A mixing head comprising,
 - (a) two pair of coaxially spaced disks disposed in side by side relationship,
 - (b) each of said disks having a series of radially extending vanes blanked out of the respective planes thereof to define a slot operatively associated with each of said vanes,
 - (c) the vanes of the respective disks being alternately bent to either side thereof the vanes bent to the outer side of the respective pairs of disks being inclined in the direction of rotation at an acute angle with respect to the plane of the respective disks of said pairs of disks, and the vanes bent inwardly of said pairs of disks being disposed at an angle substantially normal to the plane of the respective disks of said pairs of disks.
6. The invention as defined in claim 5 including means to counter-rotate the respective pairs of coaxially spaced disks relative to one another.
7. A mixing head adaptor for use on an electric mixer comprising,
 - (a) a gear housing including a drive gear and driven gear rotatably journaled therein in meshing relationship,
 - (b) a drive shaft connected to said drive gear,
 - (c) said drive shaft being adapted to be detachably connected to the mixer,
 - (d) a driven shaft connected to said driven gear,
 - (e) a mixing head connected to said driven shaft,
 - (f) said mixing head including a pair of spaced disc members,
 - (g) each of said disc members having a plurality of slots,
 - (h) vane means operatively associated with each of said slots, and
 - (i) alternate vanes on each of said discs being oppositely bent to extend outwardly and inwardly to either side of the respective disc,
 - (j) the vanes bent outwardly of their respective plates being inclined at an acute angle to the plane of their respective plate members in the direction of rotation of said head, and
 - (k) the vanes bent inwardly of the respective plates being disposed substantially normal to the plane of their respective plates.
8. An adaptor for use on a mixer having an electric drive means comprising,
 - (a) a gear housing including a drive gear and driven gear rotatably journaled therein in meshing relationship therein,
 - (b) a drive shaft connected to said drive gear,
 - (c) said drive shaft being adapted to be detachably connected to the electric drive of the mixer,
 - (d) a driven shaft connected to said driven gear,
 - (e) a mixing head connected to said driven shaft,
 - (f) said mixing head including a pair of spaced plate members,
 - (g) each of said plate members including a plurality of radially extending slots formed therein, each of said slots having a leading edge and a trailing edge,
 - (h) an imperforate vane operatively associated with each of said slots,
 - (i) each of said vanes being bent out of the plane of its respective plate member along the trailing edge of the slot associated therewith,
 - (j) and the vanes on each of said plate being alternately directed to either side of the plane of the respective disk whereby the outwardly disposed vane of the respective disks are opposite one another,

- and the inwardly disposed vane are disposed opposite one another,
- (k) the vanes bent outwardly of their respective plates being inclined at an acute angle to the plane of their respective plate members in the direction of rotation of said head, and
- (l) the vanes bent inwardly of the respective plates being disposed substantially normal to the plane of their respective plates.
9. A mixing device comprising,
- (a) a mixing head including,
- (b) a shaft adapted to be rotated,
- (c) a pair of spaced plates mounted adjacent the end of said shaft,
- (d) each of said plates having a series of circumferentially spaced radially extending slots,
- (e) an imperforate vane operatively associated with each of said slots,
- (f) said plates being mounted on said shaft so that the slots in each of said plates are axially aligned,
- (g) the vane associated with each of the alternately spaced slots being directed inwardly into the space defined between said spaced plates,
- (h) and the vane associated with the slots formed between said alternate slots of each plate being bent outwardly from the plane of the respective plates for directing the fluid to be mixed through the associated slot and into the space between said plates to effect intimate mixing of the fluid,
- (i) and the inwardly extending vanes of the respective plates functioning to radially discharge the fluid outwardly from between said spaced plates during a mixing action of said device,
- (j) the vanes bent outwardly of their respective plates being inclined at an acute angle to the plane of their respective plate members in the direction of rotation of said head, and
- (k) the vanes bent inwardly of the respective plates being disposed substantially normal to the plane of their respective plates.
10. An egg beater comprising,
- (a) a handle frame portion,
- (b) a turn crank and connected shafts rotatably journaled on said frame portion,
- (c) a pair of drive wheels journaled on said shafts in spaced relationship to rotate with said shaft when said turn crank is rotated,
- (d) a mixing head connected in driving relation with each of said drive wheels, said mixing heads being operatively associated with their respective drive wheels so as to counter-rotate relative to each other when said crank is turned,
- (e) each of said mixing heads including a pair of spaced plate members,
- (f) the spaced plate members of each head having a series of slots formed therein,
- (g) vane means operatively associated with the slots of each of said spaced plates,
- (h) alternate vane means on each of said spaced plates are oppositely directed to either side of the plane of the respective plates so that in operation the vanes of said spaced plates function to direct streams of fluid toward one another in the space defined between said plate members, and other of said vane means function to discharge the fluid from between said pair of plate members of each head radially outwardly therefrom,
- (i) and the vanes discharging radially of the counter-rotating heads causing the fluid so discharged to be directed toward one another to effect a compression action therebetween to enhance intimate mixing.
11. An egg beater comprising,
- (a) a handle frame portion,
- (b) a shaft rotatably journaled on said handle frame portion,

- (c) a pair of drive wheels journaled to said shaft in spaced relationship,
- (d) each of said drive wheels having a row of gear teeth formed along the outside edge thereof respectively,
- (e) a U shaped wire frame having opposed leg portions, the ends of said leg portions being secured to said handle portion,
- (f) the axis of said shaft being coincident in the plane of said U shaped wire frame,
- (g) a hollow shaft rotatably journaled on each leg portion of said U shaped frame,
- (h) a bevel gear connected to each of the upper ends of the respective hollow shafts,
- (i) each of said bevel gears being disposed in meshing relationship with the gear teeth of the adjacent drive wheel,
- (j) a mixing head connected to the other end of the respective hollow shafts,
- (k) a turn crank connected to said drive shaft to effect the driving thereof whereby said hollow shafts and connected mixing heads are driven in counter-rotation with respect to one another,
- (l) each of said mixing heads including a pair of spaced disks,
- (m) each of said pair of spaced disks having a plurality of radially extending slots formed therein,
- (n) each of said slots having a leading and trailing edge portion in the respective direction of rotation thereof,
- (o) an imperforate vane operatively associated with each of said slot, each of said vanes being bent out of the plane of its respective disk along the trailing edge of its respective slot,
- (p) said pair of disks being disposed so that the respective slots thereof are in vertical alignment,
- (q) the vane associated with alternate slots of said paired disk being bent outwardly of their respective disks and inclined relative thereof to define an acute angle in the respective direction of rotation thereof so as to direct fluid inwardly through the associated slot and into the space defined between said paired disks,
- (r) and the vanes associated with the other slots in said pair of disks being bent inwardly of their respective disk so as to be directed toward one another,
- (s) said inwardly directed vanes being disposed substantially normal to the plane of their respective disks whereby said inwardly directive vanes are vertically aligned to discharge the fluid from between said disks in a radially outwardly direction therefrom when in operation.
12. The invention as defined in claim 11 and including,
- (a) a pair of auxiliary wire frame portions disposed transversely of said U-shaped frame portion,
- (b) each of said auxiliary frame members having a laterally bent portion for accommodating said mixing heads.
13. An egg beater comprising,
- (a) a handle frame portion having a yoke,
- (b) a shaft rotatably journaled transversely of said yoke,
- (c) a drive wheel journaled to said shaft within said yoke,
- (d) said drive wheel having a row of gear teeth formed along the opposed outside edge thereof respectively,
- (e) a U shaped wire frame having opposed leg portions, the ends of said leg portions being secured to said handle portion,
- (f) the plane of said U shaped wire frame being coincident with the axis of said shaft,
- (g) a hollow shaft rotatably journaled on each leg portion of said U-shaped frame,
- (h) a bevel gear connected to the upper end of each of the respective hollow shafts,

9

- (i) each of said bevel gear being disposed in meshing relationship with the gear teeth formed on one side of the drive wheel,
- (j) a mixing head connected to the other end of each of the respective hollow shafts, 5
- (k) means connected to said shaft to effect the driving thereof whereby said hollow shafts and connected mixing heads are driven in counter-rotation relative one another,
- (l) each of said mixing heads including a pair of spaced disks, 10
- (m) each of said pair of spaced disks having a plurality of radially extending slots,
- (n) each of said slots having a leading and trailing edge portion, 15
- (o) an imperforate vane operatively associated with each of said slots, each of said vanes being bent out of the plane of its respective disk,
- (p) the slots of each pair of disks being disposed in alignment, 20
- (q) the vanes associated with alternate slots of said paired disk being bent outwardly of their respective disks and inclined relative thereof in the respective direction of rotation so as to direct fluid through the associated slot and inwardly to the space defined between said paired disks, 25
- (r) and the vanes associated with the other slots of

10

- said pair of disks being bent inwardly of the respective disk so as to be directed toward one another,
- (s) said inwardly directed vanes being disposed substantially normal to the plane of their respective disks whereby said inwardly directive vanes function to discharge the fluid from between said disks radially outwardly direction therefrom when place in operation.

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