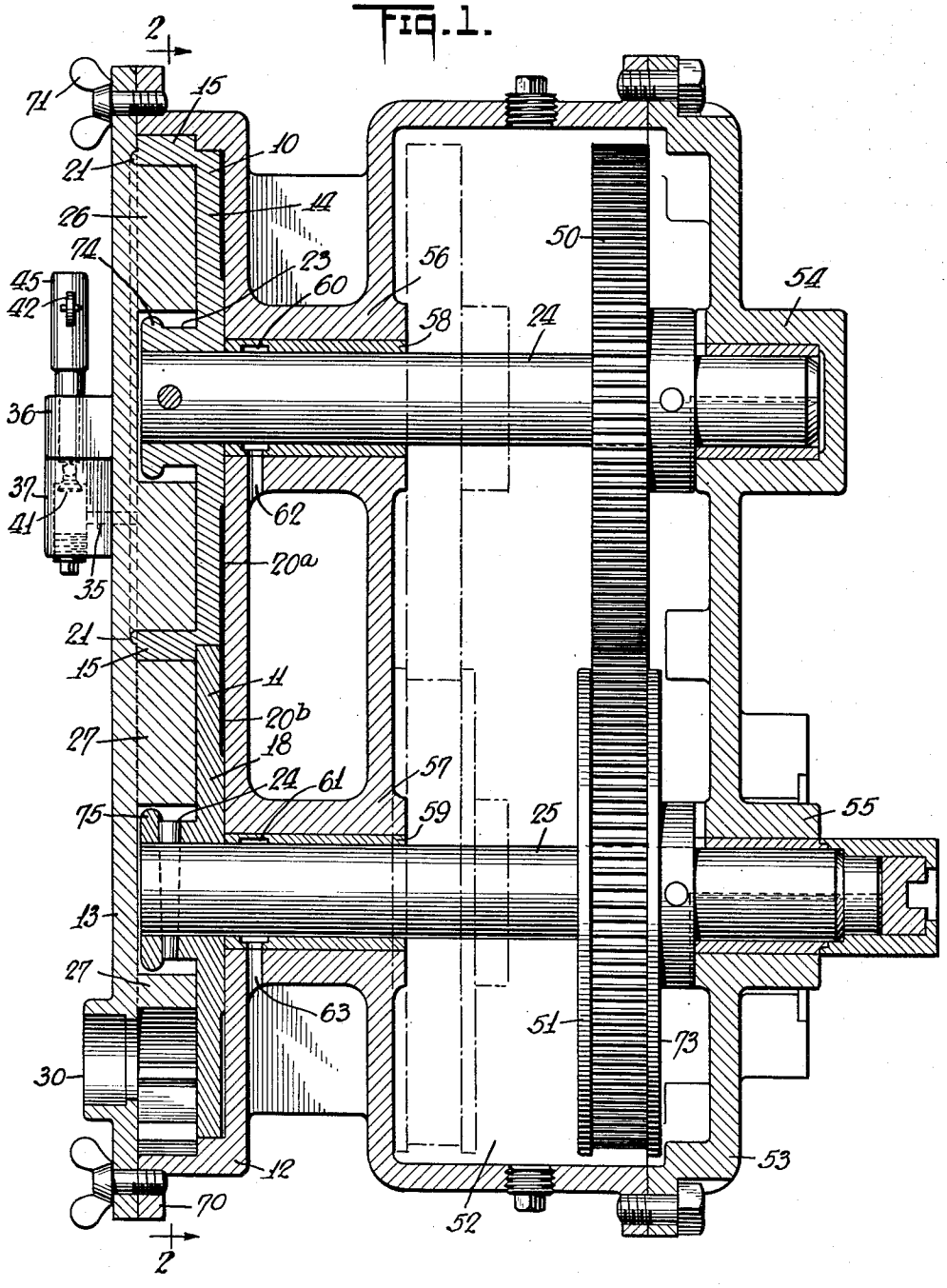
March 21, 1933. C. W. VOGT ET AL 1,902,347

ROTARY GEAR PUMP

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Fig. 1.



INVENTORS
Clarence W. Vogt
Walter E. Zoeller
BY
Dean Turnbank Hirsch & Foster
ATTORNEYS

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Fig. 2.

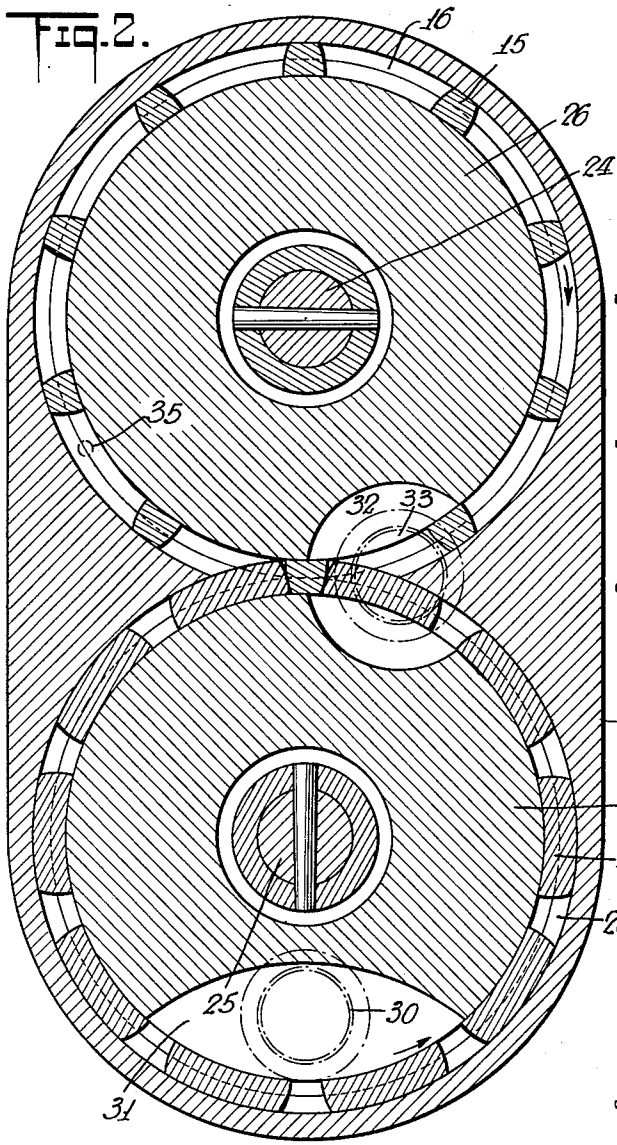


Fig. 3.

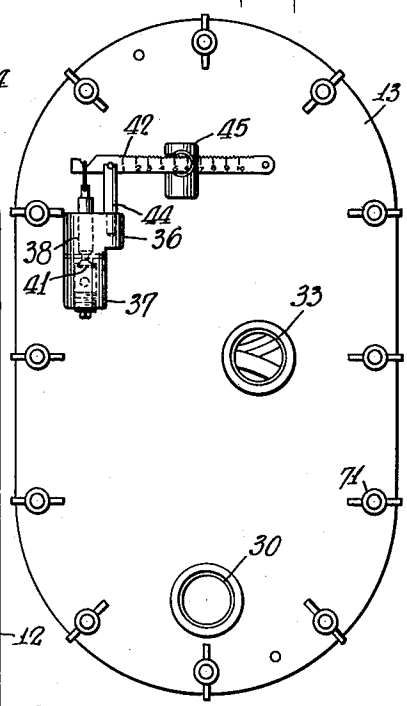


Fig. 5.

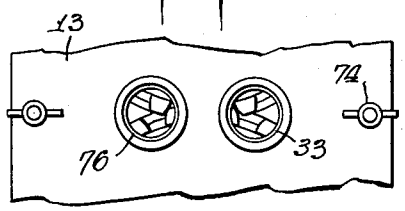
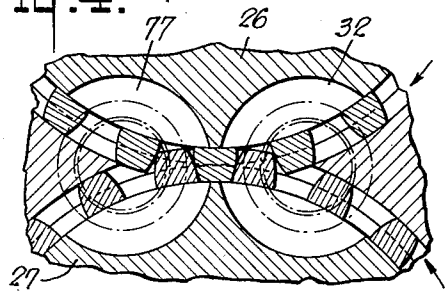


Fig. 4.



INVENTORS
Clarence W. Vogt
Walter E. Zoellner
BY
Dean Fairbank Hirsch & Foster
ATTORNEYS

Patented Mar. 21, 1933

1,902,347

UNITED STATES PATENT OFFICE

CLARENCE W. VOGT AND WALTER E. ZOELLER, OF LOUISVILLE, KENTUCKY, ASSIGNORS TO VOGT INSTANT FREEZERS, INCORPORATED, OF LOUISVILLE, KENTUCKY, A CORPORATION OF DELAWARE

ROTARY GEAR PUMP

Application filed January 31, 1931. Serial No. 512,525.

The ordinary rotary type of rotary gear pump may be used very advantageously for pumping various liquids or plastic materials but cannot be used successfully where the material contains lumps or chunks of solid material, such as preserves, marmalade, chili sauce, crushed fruit, or ice cream containing fruit chunks, nuts or the like. The solid pieces or particles are either crushed between the teeth of the gears forming the pump, which is undesirable if the retaining of the solid form and character is important, or the lodgment of these solid ingredients between the teeth of the gears effects a binding action between the rotating elements of the pump.

One object of the present invention is to provide a rotary gear type of pump so designed and constructed that the solid ingredients of the material being pumped are prevented from lodging between the interengaging elements of the pump and being crushed.

In the pumps for foods or ingredients of foods, it is essential that all parts of the apparatus which are exposed to contact with the material be separable so that they may be thoroughly cleaned and sterilized whenever pumping is stopped for any considerable time, as for instance over night.

With the ordinary gear pump cleaning operations have required a tedious disengagement and demounting of the various elements of the pump.

A further object of the present invention is to so construct and design a rotary gear pump that the various parts of said pump may be made readily and quickly accessible for cleaning without the necessity of extended demounting operations.

As one feature of the present invention, the pair of interengaging toothed rotors are so designed and constructed that the interdental spaces of said rotors are open ended passages instead of chambers or cavities. In pumping, the material is taken into one end of each passage and ejected from the opposite end. Thus binding or crushing of the solid material in said interdental spaces is positively prevented. The teeth of both rotors are constructed to extend axially from their associated supporting member so that the interdental spaces will be bottomless, and each tooth of each rotor merely pushes the material radially through the interdental spaces of the other.

As a further feature of the invention the pumping gears are mounted on shafts slidably mounted in the pump casing so that upon removing one wall or cover the pumping gear elements may be pulled out to such positions that they as well as the interior of the casing may be readily cleaned.

The shafts are interconnected by driving gears, and as a further feature of the invention the driving gears are sealed in a gear box and are slidable with the pumping gears, but are at all times retained in proper meshing relationship.

The invention fulfills other objects and has other novel features which will be apparent from the drawings and the following description or will be pointed out hereinafter.

In the accompanying drawings, there is shown for purposes of illustration merely one embodiment of the main feature of the present invention, although there are shown different part arrangements adapting the pump to different purposes.

In these drawings:

Fig. 1 is a section taken through the center of a gear pump embodying the present invention.

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

Fig. 3 is a front elevation of the pump on a smaller scale, the supply and delivery conduits being removed.

Fig. 4 is a fragmentary sectional view similar to a portion of Fig. 1, but showing another positioning of the inlet and outlet conduits, and

Fig. 5 is a fragmentary front elevation of a pump of the form shown in Fig. 4.

Like reference characters denote like parts in the several figures of the drawings.

In the specific gear pump illustrated, there are provided two interengaging toothed pumping rotors 10 and 11 confined in a

pumping chamber defined by a casing 12 and a readily removable head plate or wall 13 connected to one end of said casing. The rotor 10 includes a disk member 14 having integral therewith or otherwise rigidly connected thereto an annular series of teeth 15 which extend axially from said disk 14, and which are separated by interdental spaces 16. The other rotor 11 includes a similar disk member 18 having an annular series of teeth 19 axially projecting therefrom and separated by interdental spaces 20. The width and depth of the teeth of each rotor are properly proportioned to fit the interdental spaces of the other rotor and are proportioned according to the desired capacity of the pump. If the pump is for blending two fluids or other materials they are proportioned according to the proportion of the separate materials to be combined in said pump.

If the pump is for pumping and mixing two materials in the same proportions the teeth of the two rotors may be of the same width. If one material is to be delivered in larger volume than that of the other material, then the teeth of one rotor may be wide with narrow interdental spaces and the other rotor reversely formed with wide teeth and narrow spaces.

In order to minimize the area of frictional contact between the disk members 14 and 18 and the casing 12, the backs of said members have short hub portions leaving spaces 20*a* and 20*b* which are in communication with each other and which also serve to equalize the pressure upon opposite sides of the disks during pumping under pressure.

The pumping rotors 10 and 11 have their disk members circular and of the pitch diameters of the teeth. The teeth of each rotor extend radially inward as well as radially outward from the pitch circle of its rotor and therefore only approximately one half of the area of the inner end of each tooth is inside the periphery of its disk and connected thereto. The peripheries of the two disks preferably contact where the pitch circles are tangent. Thus each disk is partly behind the teeth of the other disk and relative axial movement is prevented.

If the teeth be long and narrow they may be reinforced by being connected together at their ends by a ring or collar. Such a ring 21 is shown on the end of the teeth 15 and seating in a groove in the cover 13.

The disk members 14 and 18 are provided with hubs 23 and 24 respectively, which are pinned or otherwise connected to the ends of shafts 24 and 25. The cover plate 13 is formed with or has connected thereto two projecting annular members or cores 26 and 27, each having a center space receiving the corresponding hubs 23 and 24. The outer periphery of each of said cores engages and conforms with the inner periphery or root circle of the gear teeth 15 and 19. The casing 12 has circular cavities or chambers which at their inner ends are of the diameter of the disks and in their body portions are of the diameter of the circle of the outer ends of the teeth. Thus the cores and the casing form annular trackways along which the material is conveyed between the inlet and outlet of the pump.

The outlet from the pump is formed in the cover 13 opposite the point where the teeth come into mesh and communicates with both annular trackways and the inner ends of the interdental spaces of both sets of teeth. The inlet or inlets may be positioned on the casing or the cover and may be positioned and proportioned in accordance with the material to be pumped and/or blended with another material.

The pump shown in Figs. 1, 2 and 3 is designed particularly for pumping ice cream containing solids and for also pumping and mixing with the cream a predetermined relative proportion of air or other gas.

The cover 13 is provided with a suction or inlet conduit 30 leading into a chamber 31 formed by the core 27 and inside of the row of teeth 19. The material to be pumped is forced or sucked into this chamber 31 and fills the interdental spaces 20 as fast as they come into communication with the chamber. If the pump be designed for handling two liquid, semi-liquid or plastic materials, the core 26 may be provided with a suction chamber similar to the chamber 31 and the cover 13 may be provided with a second inlet conduit.

The interdental spaces carry the material to an outlet chamber 32 which is formed in both cores where the teeth come into mesh and slightly in advance of the point of tangency of the pitch circles. Thus it communicates with the inner ends of both sets of interdental spaces. A conduit 33 leads from the chamber 32 to any desired disposal point. The outlet chamber 32 is made wide enough to embrace a sufficient portion of the pitch circle of the gear teeth so that when said teeth move into meshing relationship, a clear unobstructed radial path is provided for the material being extruded from both sets of interdental spaces. As the teeth of each rotor enter the spaces of the other, all the solid ingredients are forced out and can not be trapped and crushed between the crest of one tooth and any portion of the outer rotor.

As soon as the gear teeth reach the point of intersection of their crest circles they begin to move into engaging relationship, the teeth 19 serving to extrude the material from the interdental spaces 16 while the teeth 15 move into the interdental spaces 20. Under these conditions, both sets of in-

terdental spaces will be boundless in the direction in which the material is being forced, and extrusion therethrough will therefore be unobstructed. If the pump be taking in two separate materials, they will be delivered to the same outlet chamber and become mixed therein.

In certain industries, it is sometimes desirable to continuously blend a certain proportion of air, inert gas or other material with another material being pumped. For instance, in the manufacture of ice cream, lard, and other similar comestibles, it is desirable to combine a certain proportion of air, inert gas, or other liquid, with the mix. For that purpose, the cover plate 13 is provided with an inlet opening 35 leading into the interdental spaces 16 of the rotor 10, and controlled by suitable control valve. In the specific form, this inlet opening 35 is adapted particularly for the introduction of a gas, such as air. The amount of such gas introduced may be controlled by a valve 36 opening by suction in the interdental spaces 16 and against the action of a variable resistance. As shown the valve has a valve casing 37 communicating with the opening 35 and having a bore for the reception therein of a valve member 38, the inner end of which is adapted to engage a valve seat 41. The valve member 38 is connected to one end of a lever 42 fulcrumed on a support 44 secured to the casing 37. Mounted on said lever 42 is a weight 45 which can be shifted along said lever in accordance with the selective amount of fluid desired to be introduced into the pump. A partial vacuum exists in the spaces 16 after the teeth 19 are withdrawn therefrom and as the spaces come into registry with the inlet 35 gas is sucked in an amount dependent on the loading produced by the sliding weight.

For rotating the rotors 10 and 11, the shafts 24 and 25 have mounted thereon a pair of interengaging gears 50 and 51 respectively, which are enclosed in an oil chamber 52 having a closure member 53 bolted or otherwise connected to the casing 12. This closure member 53 is enlarged to form a journal box 54 for one end of the shaft 24, and is also provided with an annular flange 55 to form a bearing for the corresponding end of the other shaft 25. This end of the shaft 25 is provided with means for coupling it to the driving shaft of a source of power.

The shafts 24 and 25 are also supported in bearings 56 and 57 formed between the chamber 52 and the pump and lined with bearing sleeves 58 and 59 having internal annular oil collecting grooves 60 and 61 respectively. These grooves are respectively provided with vertical ports 62 and 63 leading to the outside of the casing 12. In this way, any oil which may seep along the shafts in the bearings, from the oil chamber 52 will be caught and directed to the outside of the casing 12 through the ports 62 and 63 and prevented from reaching the pumping chamber, thereby avoiding the contamination of the material being pumped.

In order to render the pump rotors and the interiors of the pump chambers behind the rotors readily accessible, the cover 13 is made easily and quickly removable. The casing 12 has a flange 70 which engages the periphery of the cover plate 13, and is connected thereto by means of stud bolts 71 having wing nuts readily removed without the use of tools.

The oil chamber 52 is of such a depth that when the cover plate 13 is removed, the shafts 24 and 25 may be slid along their bearings 56 and 57, so as to correspondingly shift the rotors 10 and 11 out of the pump chamber and permit access to the chamber behind said rotors. During this movement the gears move axially in the oil chamber and limit the outward movement of the rotors. These gears 50 and 51 are interlocked by means of flanges 73 connected to the gear 51 and engaging the sides of the gear 50, so that these gears are moved in unison. To facilitate the axial manipulation of the rotors 10 and 11, the hubs 23 and 24 are respectively provided with radially extending flanges 74 and 75 which serve as knobs or holding members.

If only a single material or mixture is to be pumped, the capacity of the pump may be increased by positioning the inlet adjacent to the point where the gears come out of mesh and centered on the side of the point of tangency of said rotors away from the outlet conduit. For instance, in Figs. 4 and 5 there is shown a construction in which the cover 13 is provided with an inlet conduit 76 leading into a suction chamber 77 embracing an area adjoining the demeshing portion of the two rotors. This chamber 77 is advantageously disposed symmetrical with respect to the outlet chamber 33 and serves to fill both series of interdental spaces 16 and 20. This arrangement not only serves to increase capacity of the pump, but also serves to eliminate vacuum conditions in the interdental spaces existing while these spaces are traveling from the point of tangency of the pitch circles to the inlet of the pump.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A rotary gear pump including a casing, a removable end wall connected to said casing and forming therewith a pumping chamber, a pair of shafts, a pair of intermeshing pumping gears connected to said

shafts and disposed in said pumping chamber, a pair of intermeshing driving gears connected to said shafts, and means for interlocking said driving gears against relative axial movement, said casing having a wall between said driving gears and spaced from the former to a distance substantially equal to the thickness of said chamber, whereby said shafts may be moved axially through said wall to such distance as will move said pumping gears out of said chamber.

2. A gear pump including a pair of circular disks, each having an annular series of axially extending teeth at the periphery, the pitch diameter of each series of teeth being equal to the diameter of its corresponding disk, and said teeth extending radially outside of and inside of the periphery of the corresponding disk, a casing having annular pathways for said teeth and of a radial width substantially equal to the radial dimensions of said teeth, an outlet chamber communicating with the outer and inner ends of the interdental spaces of both series of teeth at the location where said teeth come into mesh, and an inlet spaced from said outlet chamber.

3. A gear pump including a pair of circular disks, each having an annular series of axially extending teeth at the periphery, the pitch diameter of each series of teeth being equal to the diameter of its corresponding disk, and said teeth extending radially outside of and inside of the periphery of the corresponding disk, a casing having annular pathways for said teeth and of a radial width substantially equal to the radial dimensions of said teeth, an inlet chamber communicating with the outer and inner ends of the interdental spaces of both series of teeth at the location where said teeth move out of mesh, and an outlet spaced from said inlet chamber.

4. A gear pump including a pair of circular disks, each having an annular series of axially extending teeth at the periphery, the pitch diameter of each series of teeth being equal to the diameter of its corresponding disk, and said teeth extending radially outside of and inside of the periphery of the corresponding disk, a casing having annular pathways for said teeth and of a radial width substantially equal to the radial dimensions of said teeth, an outlet chamber communicating with the outer and inner ends of the interdental spaces of both series of teeth at the location where said teeth come into mesh, and separate inlets to the interdental spaces of said disks.

5. A gear pump including a pair of circular disks, each having an annular series of axially extending teeth at the periphery, the pitch diameter of each series of teeth being equal to the diameter of its corresponding disk, and said teeth extending radially outside of and inside of the periphery of the corresponding disk, a casing having annular pathways for said teeth and of a radial width substantially equal to the radial dimensions of said teeth, an outlet chamber communicating with the outer and inner ends of the interdental spaces of both series of teeth at the location where said teeth come into mesh, and an inlet chamber communicating with the outer and inner ends of the interdental spaces at both series of teeth at the location where said teeth move out of mesh.

6. A rotary gear pump including a casing having a pumping chamber and a driving gear chamber and including a removable cover for the pumping chamber, a pair of parallel shafts projecting into both chambers, a pair of intermeshing pumping gears connected to said shafts in said pumping chamber, a pair of driving gears connected to said shafts in said driving gear chamber, said shafts and gears being axially slidable when said cover is removed, said driving gear chamber being of such dimension in respect to the thickness of said driving gears that during said sliding movement said pumping gears may be moved axially out of said pumping chamber and the operation of said pumping chamber behind said pumping gears made accessible.

7. A rotary gear pump as defined in claim 6 and which is provided with means preventing relative axial movement of said shafts when said cover is removed.

8. A rotary gear pump as defined in claim 6 in which said cover member normally prevents axial movement of said shafts and in which one of said pair of gears is provided with means engaging the other gear of the said pair to prevent relative axial movement when said cover is removed.

Signed at Louisville, Ky., in the county of Jefferson and State of Kentucky this 28th day of Jan. 1931.

CLARENCE W. VOGT.
WALTER E. ZOELLER.