

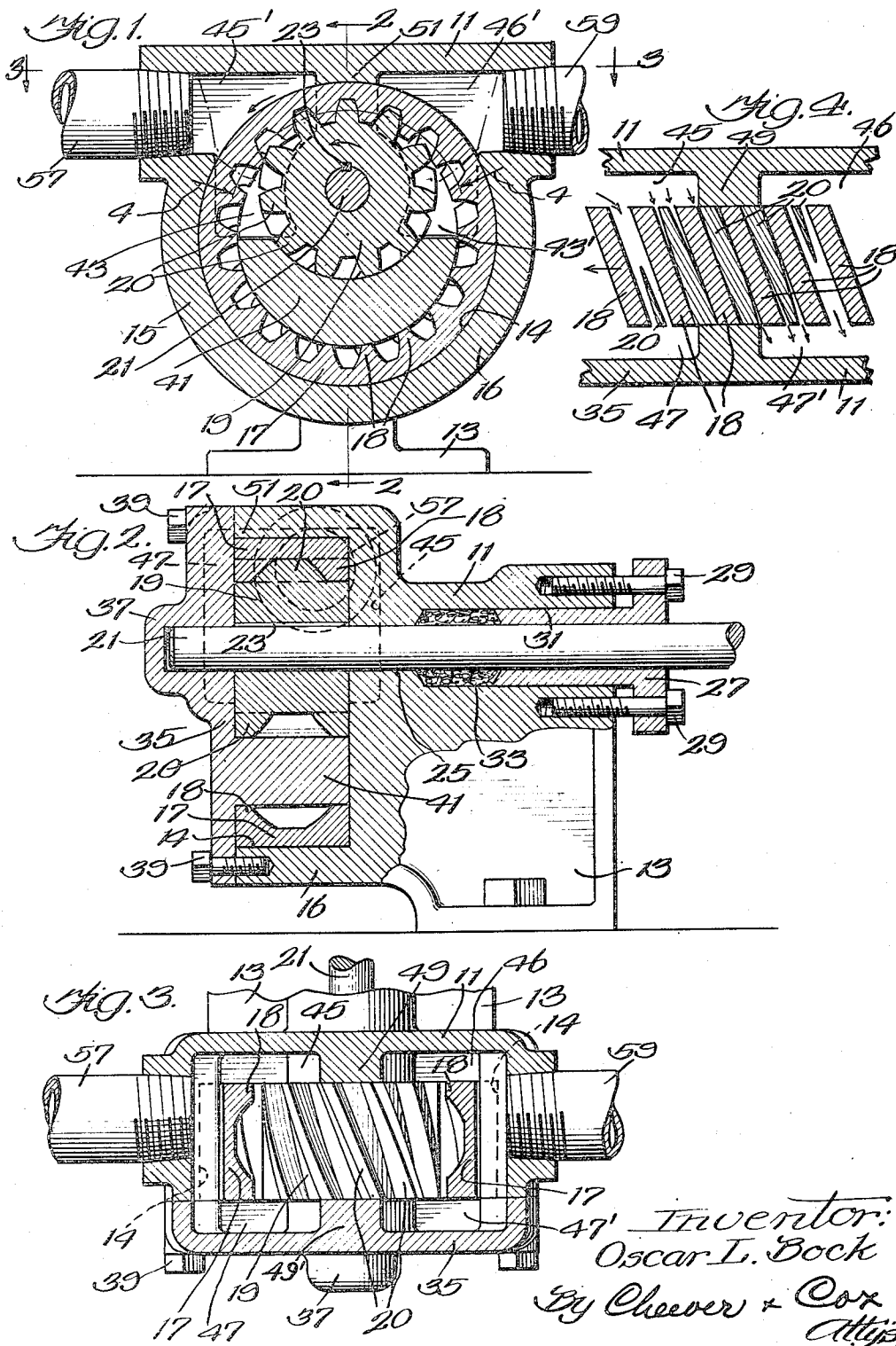
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O. L. BOCK

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INTERNAL GEAR PUMP

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Inventor:
Oscar L. Bock
By Cheever & Cox
Attys.

UNITED STATES PATENT OFFICE

OSCAR L. BOCK, OF CHICAGO, ILLINOIS

INTERNAL-GEAR PUMP

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My invention relates in general to rotary pumps of the internal gear type and has more particular reference to the provision of an improved pump having an impeller element comprising an internally driven helical ring gear.

The principal object of my present invention is the provision of a rotary gear pump of novel construction whereby operating noise is reduced, a more uniform flow of fluids through the pump is obtained, and a pump having fewer operating parts is provided.

Another important object of the invention is the provision of a pump having a minimum number of necessary parts and in which the necessary parts are themselves of simplified construction.

Various other objects and advantages of the invention will appear as it is more fully understood from the following description which, taken in connection with the accompanying drawings, discloses a preferred embodiment.

On the drawings, Figure 1 is a cross sectional view through a pump embodying my invention;

Figure 2 is a vertical cross section taken substantially along the line 2—2 in Figure 1;

Figure 3 is a horizontal cross section taken substantially along the line 3—3 in Figure 1; and

Figure 4 is a sectional view taken substantially along the covered line 4—4 in Figure 1.

To illustrate the preferred embodiment of my invention, I have shown on the drawings a main body 11 comprising a symmetrical casing for the pump formed to provide an integral supporting base 13 and a shallow housing 15 for a ring gear 17. The housing is open at the front and has cylindrical side walls 16 arranged to form a bearing seat 14 in which the ring gear 17 may be journaled, the ring gear being provided with smooth outer surfaces for engaging the sides of the cylindrical housing 15. The ring gear 17 is provided with internal helical teeth 18 and is driven internally by a pinion 19 having helical teeth 20 formed to co-operate with the teeth 18 to provide driving engagement between the pinion and the ring gear. The pin-

ion 19 is keyed to a horizontal drive shaft 21 by means of a key 23, the shaft 21 being suitably journaled at 25 in the body 11 and in a packing gland 27 which is secured in a seat 31 formed in the body 11, and is adapted to maintain and rotate the pinion in driving position. The packing gland is secured in place by means of bolts 29 engaging the head of the gland and taking into the body 11. Packing material 33 is or may be arranged in the inner portions of the seat 31 and around the shaft 21 to prevent axial leakage along the shaft, and is held in arranged position by the packing gland 27.

The open side of the shallow cylindrical housing 15 is closed by a cover plate 35, which serves to secure the ring gear in place in the seat 14 and which has an offset portion arranged to form a bearing 37 for receiving and supporting the outer end of the shaft 21. The cover plate is secured across the open side of the housing 15 by means of bolts 39 which engage the cover plate and take into the side walls 16. The cover plate 35 also carries a projection 41 which extends within the housing 15 and which is substantially crescent shaped in cross section, and adapted to completely fill the space between the pinion 19 and the ring gear 17. The tips of the crescent are cut away to provide somewhat triangular spaces 43 and 43' between the pinion and ring gear immediately adjacent the points at which the teeth 18 and 20 respectively, mesh and unmesh. These triangular spaces 43 in effect form pockets, or relatively small reservoirs, which when the pump is operating may fill with liquid which, on the inlet side of the pump enters from compartments 45 and 47 formed respectively in the housing 11 and in the face plate 35 at the side of the ring gear and pinion substantially opposite the ends of the pocket 43, and this liquid in the pocket 43 will flow readily into the interdental spaces communicating with this pocket whereby to fill these interdental spaces more quickly. On the outlet side of the pump, the space 43' promotes a quicker discharge due to the fact that this pocket 43' is arranged opposite the discharging teeth on the pinion and ring gear, and

permits the discharging liquid to be squeezed out not only in a lateral direction toward the side of the pinion and gear ring, but also radially into this pocket and out into discharge cavities 46 and 47' formed respectively in the back wall of the housing 15 and the face plate 35 immediately opposite the end of the space 43'. The cavities 45 and 46 in the back of the housing 11 are separated by a divided web 49, see Figure 3. In the cover plate 35, the cavities or recesses 47 and 47' are separated by a similar dividing web 49', and the seat 14 also is cut away leaving a dividing web 51, the lower surface of which is formed to provide a bearing engagement with the ring gear to keep the same centered in the remainder of the seat 14. The cavities 45 and 47 and the cavities 46 and 47' and 51, the gear 17, the pinion 19 and the crescent shaped member 41 define inlet and outlet chambers 45' and 46' respectively within the housing. It will be noted that the inlet chamber 45' and the outlet chamber 46' are disposed on opposite sides of the webs 49 and 51 and that these chambers are located in the path of travel of the teeth of the pinion and ring gear where they unmesh and mesh. A threaded inlet pipe 57 is connected so as to communicate with the inlet chamber 45' while a similar pipe 59 is threaded to the outlet chamber 46'. Obviously, in referring to these chambers 45' and 46' as inlet and outlet compartments respectively, it is to be understood that when the pump is reversely rotated the functions of these two chambers will also be reversed.

In connection with the operation of my improved pump, it should be understood that when the same is rotating at comparatively high speed, the advantageous arrangement of the present construction, including the helical arrangement of the teeth, and particularly the manner in which the liquid is both introduced and discharged from the sides of the teeth as clearly shown in Fig. 4 of the drawings, eliminates the trapping of liquid in the interdental spaces and thus eliminates hammer action and noise and will promote continuous flow and uniform delivery and discharge of the liquid by the pump. This helical construction and lateral entry and discharge of the fluid to and from the spaces between the teeth is to be distinguished from prior constructions wherein straight teeth were used. Assuming the pinion 19 is rotating counter-clockwise, viewing Figure 1, liquid being in the inlet chamber 45, the teeth 20 of the pinion will gradually unmesh from the teeth 18 of the ring gear the unmeshing action beginning at one side of the teeth 20 and moving laterally thereacross as shown in Figure 4 of the drawings. Similarly the teeth 18 of the ring gear gradually and laterally unmesh from the interdental spaces between the teeth 20 of the pinion.

This lateral unmeshing of the teeth in the inlet chamber will create a suction and will draw the inmoving column of liquid coming through pipe 57, into the space between adjacent teeth 20 being vacated by the unmeshing of the pinion teeth 18, so that the sudden opening of the teeth 20 clear across, as in prior constructions and the consequent sudden vacuum and impulse is avoided, and further, by reason of the inclination of the teeth 20 in the side which opens first, these teeth will provide a sort of deflecting action which will serve to deflect the inflowing column of liquid into these gradually enlarging interdental openings. This is a very important feature since in prior and existing straight tooth constructions, due to the high rate of speed and to the fact that the spaces between the teeth open abruptly across the entire width of the intermeshing teeth, the interdental spaces are incompletely filled with fluid being pumped and a suction is set up which creates a hammering effect, which produces violent vibration and is hence objectionable.

In the present construction, due to the gradual opening of the teeth from one side and the inclination of the teeth, the suction is created gradually and the interdental pockets fill gradually and evenly, which eliminates hammering, while at the same time the inclination of the teeth producing the scooping action which adequately fills the teeth even at the highest practical speeds. As the pinion continues to rotate and the ring gear 17 rotates, these interdental spaces are filled with liquid from the inlet chamber 45, are carried around the crescent shaped member separating the filled interdental spaces, until the teeth arrive at the discharge portion of the pump which is on the right hand side of web 51, see Fig. 1 of the drawings, at which time they will begin to gradually and laterally mesh together. This action is also shown clearly in Fig. 4 of the drawings, where the teeth are shown as closing gradually from the top. This action serves to squeeze the liquid gradually from the spaces between the teeth and to discharge it into the outlet chamber 47' and thence through the pipe 59. In this connection it will be noted that since this squeezing act or discharging operation begins at one side of the teeth and progressively occurs across the incline of the helical teeth through their entire width, the discharging liquid will be forced out gradually and this prevents the hammer action prevalent in constructions embodying straight gear teeth. These straight teeth move so fast and due to their arrangement close the pocket from which the liquid is discharging so abruptly that a squeezing of the liquid into the bottom of the interdental spaces occurs which promotes a hammering action; and not only that, but an abrupt periodic discharge is set

up which creates a noticeable fluctuation in the discharging fluid.

In the present device, due to the helical arrangement of the teeth at the discharge end, the outflow of the liquid is continuous, non-fluctuating and silent. It should be particularly noticed that the helix of the teeth is such that one tooth overlaps the adjacent end of the other tooth, that is to say, the center line of the leading end of one tooth is in line with the trailing end of the adjacent tooth. This overlapping construction creates a uniform flow of fluid through the pump as the gears rotate and results in a more uniform flow than is possible with teeth that are arranged directly across, as in present construction.

Another advantage in forming the gears with helical teeth resides in the ease with which the rotating portions of the pump may be manufactured. The ring gear is journaled in the cylindrical casing 15 and is driven by the pinion from within, and it is therefore not necessary to provide complicated means for journaling the ring gear. The ring gear, moreover, may be formed on the ordinary gear shaper which is a much simpler operation than that required to cut the ring gear in the types of pump heretofore provided in which the outer or ring gear comprises the driving member of the gear combination. In such case it is necessary to cut a bastard tooth form close up to a shoulder. The device of my present invention, therefore, provides an inexpensive, simple and rugged pump through which the flow of fluids takes place at a substantially uniform rate and this in turn promotes noiseless operation.

It is thought that the invention and numerous of its attendant advantages will be understood from the foregoing description and it is obvious that numerous changes may be made in the form, construction and arrangement of the various parts without departing from the spirit and scope of the invention or sacrificing any of its material advantages, the form herein described being a preferred embodiment of the invention.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A fluid pump of the internal gear type having a co-operating impelling gear, said internal gear and impelling gear having helical teeth, said pump having a liquid inlet chamber arranged to permit fluid to flow into the spaces between the teeth of said gears, and a liquid outlet chamber to receive fluid expelled from the opposed ends of said spaces.

2. A fluid pump comprising a housing formed and arranged to provide intake and outlet chambers and a seat for a ring gear, a ring gear having helical teeth rotatably mounted in said seat, a pinion having driving

engagement with said ring gear rotatably mounted within said housing and means for rotating said pinion, said intake chamber being open to the ring gear where the pinion unmeshes therefrom and the outlet being open to the ring gear where the pinion engages the ring gear, whereby the fluid pumped may pass longitudinally across the teeth of the gear and pinion during the pumping operation.

3. A fluid pump comprising a casing having a pinion and an internal ring gear formed with intermeshing teeth disposed at an inclination with respect to the axis of rotation of the pinion and means for admitting fluid into the spaces between the unmeshing teeth at one side of said ring gear and for discharging the fluid from the opposed side of the gear at the point where the pinion and ring gear mesh.

4. A fluid pump comprising a casing enclosing a rotatable pinion and a ring gear having teeth adapted to mesh with said pinion and means for admitting liquid at one side of the gear into the spaces between the unmeshing teeth of the pinion and gear ring and for discharging the liquid from the spaces between the meshing teeth at the other side of the gear.

In witness whereof, I have hereunto subscribed my name.

OSCAR L. BOCK.