July 27, 1954 R. W. ERIKSON 2,684,637

GEAR PUMP

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Fig. 1.

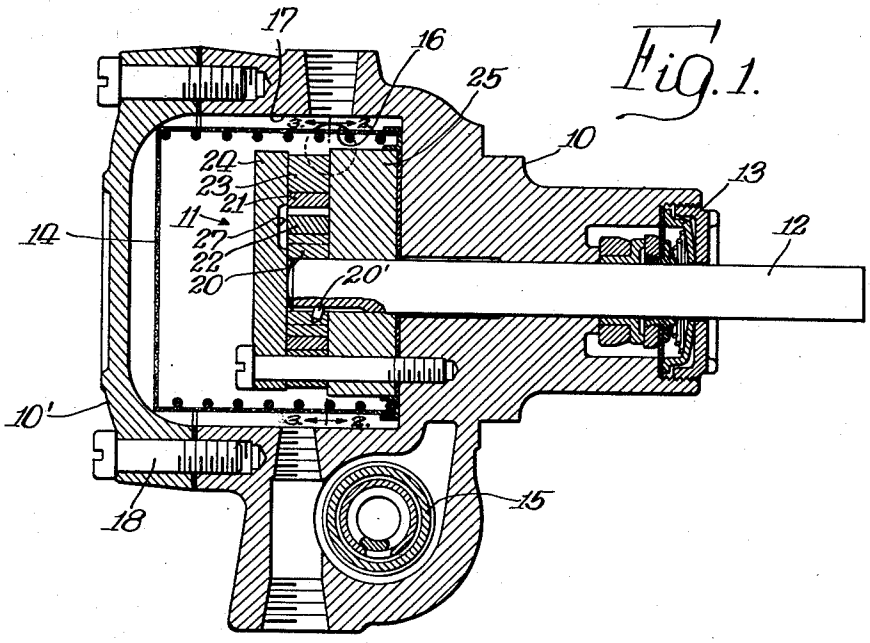


Fig. 3.

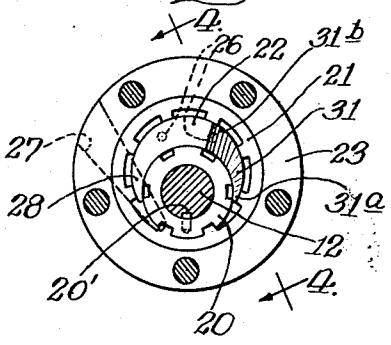


Fig. 2.

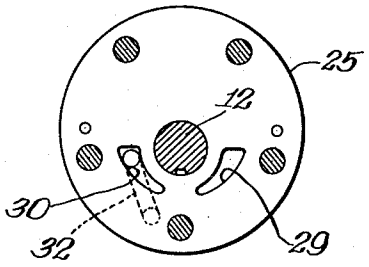
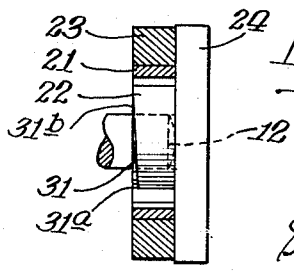


Fig. 4.



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GEAR PUMP

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9 Claims. (Cl. 103—126)

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This invention relates to a gear pump.

It is the general object of this invention to produce a new and improved gear pump.

It is a more specific object of this invention to produce a gear pump which will operate noiselessly even in the presence of air entrained in the oil being pumped.

Another object of the invention is to produce a gear pump which is provided with means for collapsing air bubbles in the gear spaces preceding the outlet port of the pump before such oil is subjected to the full extent of outlet pressure.

A further object of the invention is to produce a gear pump of the type described in the preceding paragraphs in which means are provided defining a leakage path from the outlet port to the gear spaces of the pump next preceding the outlet port in order to subject such gear spaces gradually to outlet port pressure.

Yet another object of the invention is to produce a crescent-type gear pump in which a portion of the crescent adjacent the outlet port is bevelled or cut away in order to permit leakage of the pressure in the outlet port into the gear spaces preceding the port, gradually to collapse air bubbles which may be entrained in the oil in such spaces.

Other and further objects of this invention will be apparent from the following description and drawings, in which:

Fig. 1 is a vertical central section through an oil pump embodying the invention;

Figs. 2 and 3 are vertical sections along lines 2—2 and 3—3, respectively, of Fig. 1; and

Fig. 4 is an oblique section taken substantially along line 4—4 of Fig. 3.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

In the form of the pump chosen for purposes of disclosure, there is provided a two-part casing 10, 10', a crescent-type gear pump 11, a drive shaft 12, a mechanical seal 13 for the drive shaft, a strainer 14 and an outlet port valve mechanism 15. The valve 15 is preferably of the type designed to open only after the build up of a predetermined discharge pressure and to maintain a predetermined pressure to the discharge port during operation of the pump. It is contemplated that the shaft 12 will be connected by suitable means to a driving motor (not shown), that an inlet port 16 will be connected to a source of oil supply, and the discharge valve 15 to a burner nozzle.

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The casing parts are formed to provide a chamber 17 in which the pumping device 11 and the strainer 14 are located. The part 10' is in the form of a closure or cover and is bolted to the part 10 by means of a plurality of screw devices 18.

The pumping device 11 comprises an externally toothed pinion gear 20 and an internally toothed ring gear 21 meshing with the pinion, a crescent guard element 22, and a housing for these members consisting of a circular ring 23 surrounding the gear 21 and of the same thickness as the gear, pinion and crescent. The ring 23 is mounted between an outer end plate 24 and an inner end plate 25 with the end plates serving as closures for the pumping unit.

The pinion is mounted eccentrically with respect to the center of the ring 23 and is secured to the drive shaft 12 by means of the pin 20'. The crescent member 22 fits snugly between the separated portion of the gear and pinion and is secured to the end plate 24 by means of the pins 26. The end plate 24 is provided with an inlet passage 27 which opens at one end to the chamber 17 and at the other end to the inlet port of the pump which is located at one end 28 of the crescent. Preferably, an arcuate cavity 29 is formed in the end plate 25 opposite the inlet port so as to facilitate the filling of the gear spaces in the gear and pinion. An outlet port 30 is formed in the end plate 25 adjacent the other end 31 of the crescent, and means in the form of a passage 32 are provided connecting the outlet port with the outlet valve device 15.

The crescent member 22, as previously indicated, has substantially the same thickness as the gear and pinion and as the ring 23. The outlet port end 31 of the crescent, however, is bevelled or cut away in order that the pressure existing in the outlet port may leak along a surface of the crescent and into the gear spaces next preceding the outlet port. This leakage serves to transfer at least a portion of the outlet pressure into such gear spaces to collapse air bubbles which may be entrained in the oil at a gradually increasing rate as those gear spaces approach the outlet port. This gradual collapsing of air bubbles is accompanied with practically no noise as contrasted to the pronounced noise which occurs

when the air bubbles are collapsed rapidly in the case where air bubbles are exposed to the full extent of outlet port pressure instantaneously. To this end the tip or extremity 31*a* of the crescent is cut away approximately .015 to .020 inch and is bevelled outwardly along the crescent to the point 31*b* at which point it is then flush with the remainder of the crescent. The point 31*b* is located at least one-third the distance along the crescent from end to end. Its purpose is to connect the gear spaces next preceding the outlet port with a portion of outlet port pressure and hence the length of the bevel and degree of taper may be varied to accommodate differently spaced gear spaces of the ring gear and pinion. By means of this crescent design a controlled rate of leakage from the discharge port to the gear spaces is produced which in effect creates a more gradual pressure gradient from the inlet port to the discharge port than would otherwise exist. The members comprising the pump, that is, the gear, pinion, crescent and ring, are machined to close tolerances and permit of substantially no leakage of oil except along the bevelled surface of the crescent and there only from the end 31*a* to the point 31*b*.

When the pump is operating, the pressure in the outlet passage and outlet port is maintained at a predetermined minimum due to the operation of the outlet valve 15. By the provision of the leakage path along a surface of the crescent as just described, a portion of such pressure is transmitted to the gear spaces in the pinion and ring gear as they reach the point 31*b*. This point, of course, precedes the outlet port, and as the gear spaces progress toward the outlet port the oil therein is subjected to increasing outlet port pressure due to the bevelling of the outlet port end of the crescent. This gradually increasing pressure in such gear spaces serves to compress or collapse bubbles of air at a graduated rate as contrasted with a sudden collapse which occurs when the oil in the gear spaces is subjected to the entire outlet port pressure instantaneously. Because of the gradual collapse of air bubbles in the gear spaces as they approach the outlet port, there has resulted a considerable reduction in the noise of the pump during operation.

This gradually increasing pressure can also be accomplished by an impression in the side plate of the gear set or by other bleed slots in the crescent or the side plates.

I claim:

1. A gear pump comprising a casing having a cylindrical pumping chamber with inlet and outlet ports, an internal ring gear fitting snugly and rotatably supported in the chamber, a pinion of the same thickness as and meshing with said ring gear and carried on a shaft supported eccentrically of said chamber, said pinion having an external diameter less than the internal diameter of the ring gear to provide an arcuate space therebetween, a member of the same thickness as the gear end pinion fixed in said chamber and located in said space, said member being tapered at each end to give the member the shape of a crescent with said ends being located adjacent the inlet and outlet ports of the chamber, said member having a graduated cut away portion along one surface of the end adjacent the outlet port with said cut away portion establishing communication between the outlet port and a plurality of gear spaces in the ring gear and in the pinion immediately preceding the outlet to subject oil in said gear spaces gradually to outlet port pressure with rotation of the gear and pinion.

2. A gear pump comprising a casing having a cylindrical pumping chamber with inlet and outlet ports, an internal ring gear fitting snugly and rotatably supported in the chamber, a pinion of the same thickness as and meshing with said ring gear and carried on a shaft supported eccentrically of said chamber, said pinion having an external diameter less than the internal diameter of the ring gear to provide an arcuate space therebetween, a member of the same thickness as the gear and pinion fixed in said chamber and located in said space, said member being tapered at each end to give the member the shape of a crescent with said ends being located adjacent the inlet and outlet ports of the chamber, a plate closing one end of the chamber and contacting one surface of the gear and pinion and of the member in sealing relationship, with a portion of said surface of the member at the end adjacent the outlet port being bevelled with said bevelled portion establishing communication between the outlet port and a plurality of gear spaces immediately preceding the outlet port to subject oil in the gear spaces gradually to outlet port pressure with rotation of the gear and pinion.

3. A gear pump comprising a casing having a cylindrical pumping chamber with inlet and outlet ports, an internal ring gear fitting snugly and rotatably supported in the chamber, a pinion of the same thickness as and meshing with said ring gear and carried on a shaft supported eccentrically of said chamber, said pinion having an external diameter less the internal diameter of the ring gear to provide an arcuate space therebetween, a member of the same thickness as the gear and pinion fixed in said chamber and located in said space, said member being tapered at each end to give the member the shape of a crescent with said ends being located adjacent the inlet and outlet ports of the chamber, a plate closing one end of the chamber and having a surface contacting a surface of the member in sealing relationship, with a portion of one of said surfaces adjacent the outlet port being cut away to provide a graduated leakage path between and communicating with the outlet port and a plurality of gear spaces preceding the outlet port to subject oil in said gear spaces gradually to outlet port pressure with rotation of the gear and pinion.

4. A gear pump comprising a casing having a cylindrical pumping chamber with inlet and outlet ports, an internal ring gear fitting snugly and rotatably supported in the chamber, a pinion of the same thickness as and meshing with said ring gear and carried on a shaft supported eccentrically of said chamber, said pinion having an external diameter less than the internal diameter of the ring gear to provide an arcuate space therebetween, a member of the same thickness as the gear and pinion fixed in said chamber and located in said space, said member being tapered at each end to give the member the shape of a crescent with said ends being located adjacent the inlet and outlet ports of the chamber, and means providing a graduated leakage path along one surface of the end of the member adjacent the outlet port with said cut away portion establishing communication between the outlet port and a plurality of gear spaces in the ring gear and in the pinion immediately preceding the outlet to subject oil in said gear spaces gradu-

ally to outlet port pressure with rotation of the gear and pinion.

5. A gear pump comprising a casing having a cylindrical pumping chamber provided with an inlet port, a plate closing one end of the chamber and having an outlet port communicating with the chamber, an internal ring gear fitting snugly and rotatably supported in the chamber, a pinion of the same thickness as and meshing with said ring gear and carried on a shaft supported eccentrically of said chamber, said pinion having an external diameter less than the internal diameter of the ring gear to provide an arcuate space therebetween, a member of the same thickness as the gear and pinion fixed in said chamber and located in said space, said member being tapered at each end to give the member the shape of a crescent with said ends being located adjacent the inlet and outlet ports, and means defining a leakage path along one surface of the crescent member, said path having a portion adjacent and communicating with the outlet port and a second portion extending along said member from the end thereof adjacent the outlet port, with said second portion communicating with the first portion and with a plurality of gear spaces preceding the outlet port to subject oil in said gear spaces next preceding the outlet port gradually to outlet port pressure with rotation of the gear and pinion.

6. A gear pump comprising a casing having a pumping chamber provided with an inlet port, a plate closing one end of the chamber and having an outlet port communicating with the chamber, a gear rotatably mounted in the chamber, a second gear having the same thickness as and rotatably mounted in the chamber so as to have a first portion thereof meshing with said first gear, and a second portion unmeshed with and spaced from said first gear, a member of the same thickness as the gears fixed in said chamber and located at the outlet port in said space adjacent the outlet port, said member having a portion cut away along one surface adjacent the outlet port with said cut away portion establishing communication between the outlet port and a plurality of gear spaces in the ring gear and in the pinion immediately preceding the outlet to subject oil in said gear spaces next preceding the outlet port gradually to outlet port pressure with rotation of the gears.

7. A gear pump comprising a casing having a pumping chamber provided with inlet and outlet ports, a gear rotatably supported in the chamber, a second gear of the same thickness as and mounted to have a portion meshing with the first gear and a portion spaced therefrom, a member of the same thickness as the gears fixed in said chamber and located adjacent the outlet port between and in substantially sealing relationship with the spaced portion of said gears, and means defining a graduated leakage path in said chamber along a surface of said member, said path having a portion in communication with the outlet port and having a portion in communication with the first mentioned portion and with a plurality of gear spaces next preceding the outlet port to subject oil in said gear spaces gradually to outlet port pressure with rotation of the gears.

8. A gear pump comprising a casing having a cylindrical pumping chamber with inlet and outlet ports, an internal ring gear fitting snugly and rotatably supported in the chamber, a pinion of the same thickness as and meshing with said ring gear and carried on a shaft supported eccentrically of said chamber, said pinion having an external diameter less than the internal diameter of the ring gear to provide an arcuate space therebetween, a member of the same thickness as the gear and pinion fixed in said chamber and located in said space, said member being tapered at each end to give the member the shape of a crescent with said ends being located adjacent the inlet and outlet ports of the chamber, said member being bevelled at the outlet port end, said bevel having a maximum depth of approximately .015 to .020 inch at said end and a length approximately equal to one-third the length of the crescent member with said bevel establishing communication between the outlet port and a plurality of gear spaces in the ring gear and in the pinion immediately preceding the outlet to subject oil in said gear spaces gradually to outlet port pressure with rotation of the gear and pinion.

9. A gear pump comprising a casing having a cylindrical pumping chamber with inlet and outlet ports, an internal ring gear fitting snugly and rotatably supported in the chamber, a pinion of the same thickness as and meshing with said ring gear and carried on a shaft supported eccentrically of said chamber, said pinion having an external diameter less than the internal diameter of the ring gear to provide an arcuate space therebetween, a member of the same thickness as the gear and pinion fixed in said chamber and located in said space, said member being tapered at each end to give the member the shape of a crescent with said ends being located adjacent the inlet and outlet ports of the chamber, said member being bevelled at the outlet port end, said bevel having a maximum depth of approximately .015 to .020 inch at said end and a length sufficient to connect said outlet port to the next preceding gear spaces to subject oil in said gear spaces gradually to outlet port pressure with rotation of the gear and pinion.

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