July 7, 1964 O. C. BLOMGREN ETAL 3,139,834

GEAR PUMP ASSEMBLY

Filed July 13, 1960 2 Sheets-Sheet 1

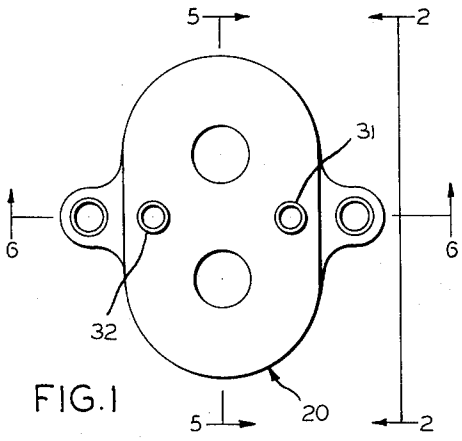


FIG. 1

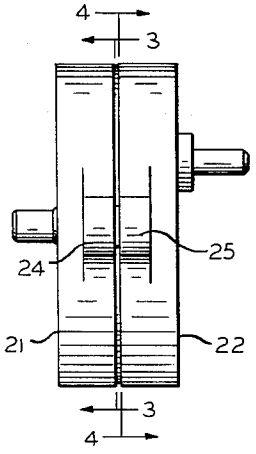


FIG. 2

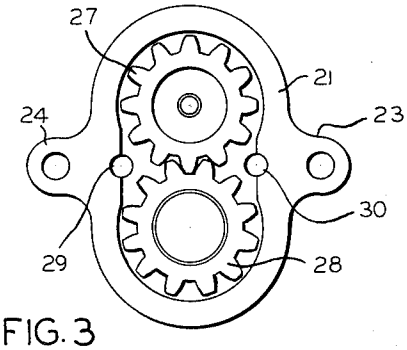


FIG. 3

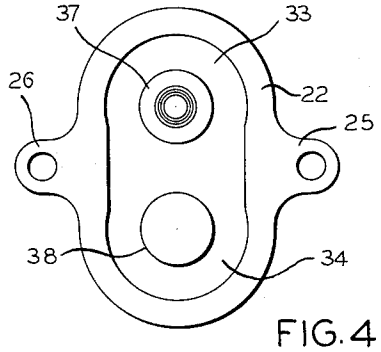


FIG. 4

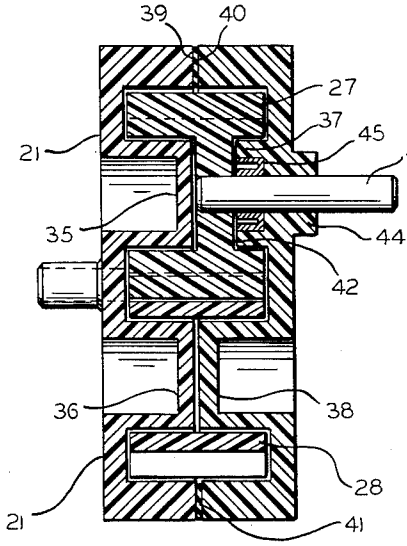


FIG. 5

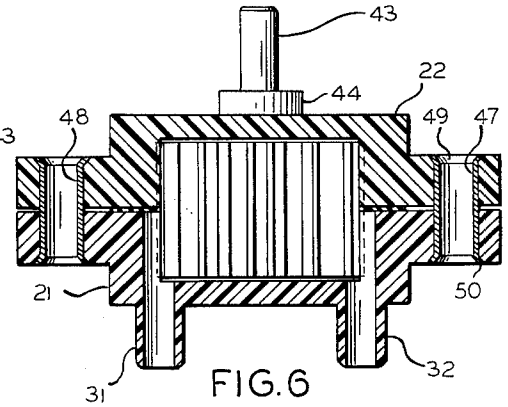


FIG. 6

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July 7, 1964 O. C. BLOMGREN ETAL 3,139,834

GEAR PUMP ASSEMBLY

Filed July 13, 1960 2 Sheets-Sheet 2

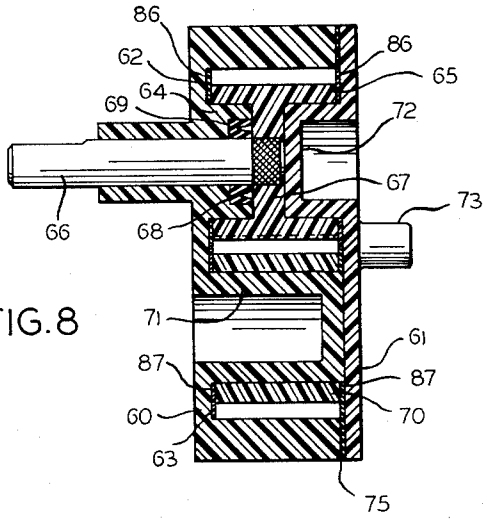


FIG.8

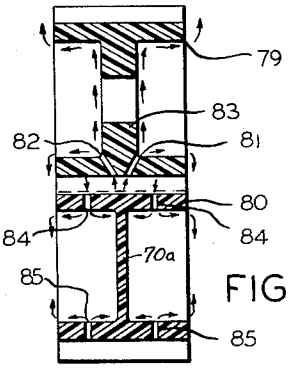


FIG.10

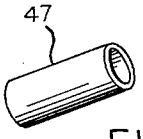


FIG.7

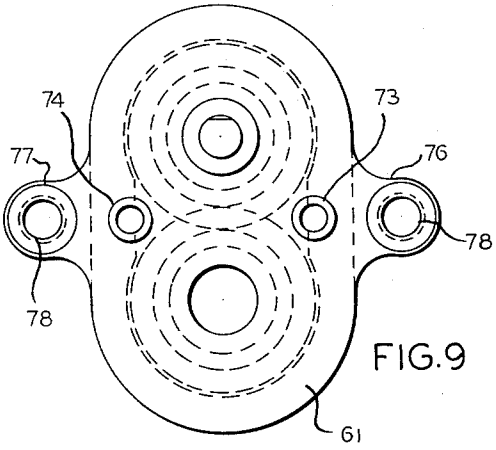


FIG.9

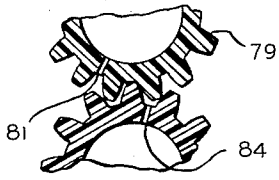


FIG.11

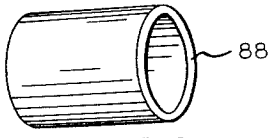


FIG.14

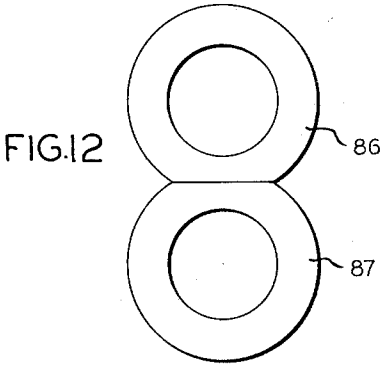


FIG.12

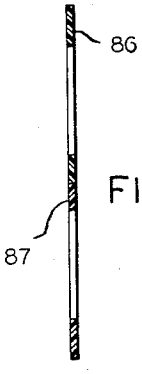


FIG.13

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GEAR PUMP ASSEMBLY

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Filed July 13, 1960, Ser. No. 42,573
16 Claims. (Cl. 103—126)

The present invention is directed to improvements in pump assemblies and is particularly concerned with the fabrication of a gear type pump in a simple, efficient and inexpensive manner.

A major purpose of the present invention is to so form and arrange a gear pump housing, drive gear and idler gear, that these parts can be fabricated from molded material, such as plastic, and assembled together with a minimum of elements, all of which lends decided economies in the manufacture of pumps. By using the principles of the present invention it is possible to fabricate very small pumps, which may be, for example, only two inches long in the major dimension, in a very inexpensive manner while retaining the customary working efficiencies found in gear pumps. The principles of the invention are, of course, applicable to pumps of a much larger size.

Another and related purpose of the present invention is to create simplified bearing structures for the working gears of a gear pump, while at the same time insuring against overheating of the cooperating bearing elements.

Another purpose of the present invention is the provision of simplified means for holding plural sections of a pump housing together while at the same time providing thrust absorbing supports for attaching the pump assembly to a wall or other support.

Other purposes will appear from time to time in the course of the ensuing specification and claims, when taken with the accompanying drawings, in which:

FIGURE 1 is a front elevation of the pump of the present invention;

FIGURE 2 is a side elevation of the assembly illustrated in FIGURE 1;

FIGURE 3 is a sectional illustration taken on the section lines 3—3 of FIGURE 2;

FIGURE 4 is a sectional illustration taken on the section line 4—4 of FIGURE 2;

FIGURE 5 is a sectional illustration of the assembly taken on the assembly line of 5—5 of FIGURE 1;

FIGURE 6 is a sectional illustration taken on the section line 6—6 of FIGURE 1;

FIGURE 7 is a perspective view of a fastening element utilized in the invention;

FIGURE 8 is a sectional illustration illustrating a further embodiment of the invention;

FIGURE 9 is a front elevation of the embodiment of FIGURE 8;

FIGURE 10 is a sectional illustration of certain gears which may be used in the invention;

FIGURE 11 is a sectional view, in side elevation, of the gears, shown in FIGURE 10;

FIGURE 12 is a front elevation of anti-friction washers which may be used in the invention;

FIGURE 13 is a side view of the washers shown in FIGURE 12; and

FIGURE 14 is a perspective view of a bearing element.

Like elements are designated by like characters throughout the specification and drawings.

With specific reference now to the drawing and in the first instance to FIGURE 1, the numeral 20 generally designates a gear pump housing or enclosure, which, as will be seen in FIGURE 2, is comprised of a pair of opposed housing half sections 21 and 22. The housing section 21, which is illustrated in FIGURE 3, includes

laterally extending flanges or ears 23 and 24, which are molded integrally with the remainder of the housing section 21. The housing section 22, which is best seen in FIGURE 4, similarly includes laterally extending flanges or ears 25 and 26, which are adapted to be aligned with and opposed to the flanges 23 and 24 of the housing section 21 for the purpose of holding the two sections 21 and 22 together and for fastening the housing to a supporting wall or other supporting structure in a manner to be pointed out more fully in the following specification. The flanges 25 and 26 are also molded integrally with their associated housing section 22.

In FIGURES 3 and 5, a drive gear 27 is illustrated in rotary engagement with an idler gear 28 so that upon rotation of these gears, fluid may be forcibly delivered through the spaces on opposite sides of the meshing teeth of the gears and into and out of inlet and outlet ports 29 and 30 which are formed in one housing section 21. Port 29 may lead through a tubular projection 31 which extends from the outside of the section 21, whereas the port 30 may extend through a tubular projection 32 which is also formed on the exterior of the housing section 21. The tubular projections 31 and 32 provide a convenient means for attaching inlet and outlet tubular conduits thereto for use in a fluid delivery system.

In accordance with the principles of the invention, the housing sections 21 and 22 and the drive and idler gears each may be formed of molded plastic material, such as for example, that plastic material which is available under the commercial name of "Delrin."

Each of the housing sections 21 and 22 is so formed as to define a drive gear cavity and an idler gear cavity, the two housing sections together cooperatively defining the cavities 33 and 34, respectively. One housing section, as for example section 21, is so formed as to provide spaced bearing bosses 35 and 36 which project into the drive gear and idler gear cavities 33 and 34. The other housing section 22 is also formed with inwardly projecting bearing bosses 37 and 38, which bosses are opposed to the bearing bosses 35 and 36, respectively. It should be noted that the inner faces of the bosses 35 and 36 are substantially coplanar with the external rim 39 of the section 21. The inner face of the boss 38 in section 22 is also substantially coplanar with the peripherally extending rim 40 of the housing section 22. The face of the boss 37 is spaced from the rim 40 of the section 22. A gasket which may be formed of paper or the like as at 41 is positioned between the peripherally extending rims 39 and 40 of the two sections and may provide a small space between the opposed faces of the bearing bosses 36 and 38.

The idler gear 28 is formed as a cylindrical element with an inner open ended cylindrical bearing wall and gear teeth on the exterior thereof so that the idler gear is rotatably supported on the bosses 36 and 38. The idler gear 28 is freely slidable on these bosses. Lateral play of the idler gear is prevented only by contact with the material of the housing sections, or with washers between the gears and sections as hereinafter pointed out. The drive gear 27 is formed with tubular recesses, the cylindrically formed walls of which fit over and rotatably engage the cylindrical surfaces of the bosses 35 and 37. The drive gear 27 includes a web 42, which is offset from the center line of the drive gear, as is best seen in FIGURE 5, and which has a thickness such that it substantially fills the space between the opposed faces of the bosses 35 and 37. The web 42 is adapted to provide substantial support for a drive shaft 43 which is fixed to the web 42, as by means of a press fit or a key and key way arrangement. The drive shaft extends through a bore in the section 22, which section may be provided

with an externally formed bearing boss 44 to provide additional supporting area for the shaft 43. A packing element, which may be formed of leather or other equivalent material, is designated at 45, and seals shaft 43 to the housing.

In order to secure the two housing sections together in a fluid tight relation, cylindrical metal tubes 47 and 48, as illustrated in FIGURE 7, are inserted within the apertures of the ears of the flanges 23, 24, 25 and 26. The tubes 47 and 48 have a tight fitting relation with these apertures and are preferably press fitted in the apertures. Thus insertion of these tubes brings about a precise alignment of the housing sections 21 and 22.

After insertion the opposite ends of the tubes are upset and flared outwardly as appears in FIGURE 6. This upsetting operation forces the metal in the ends of the tubes in a direction parallel to the axes of the gears and against the material of the housing sections, thus forcing the two housing sections tightly together. The upset end portions may be staked to the material of the housing sections in the outwardly flared relation illustrated in FIGURE 6. In some cases the material of the housing sections surrounding the apertures may be beveled so that the upsetting operation produces a similar bevel or inclination of the material in the end portions of the tubes as appears in FIGURE 6.

Thus the tubes 47 and 48 bring about a precise alignment of the housing sections and hold the sections aligned and pressed together in a fluid tight relation.

After assembly the tubes 47 and 48 are used as a mounting means for the assembly. In this connection screws or bolts may be passed through the tubes and fixed to a supporting wall. The heads of the screws or bolts are then in contact with the flared end portions of the tubes and the metallic tubes themselves take the thrust and stresses of these screws or bolts.

In some cases the idler gear 28 may include a thin central web, the web having sufficient thickness to substantially fill the small space between the opposite end faces of the supporting bosses 36 and 38. Such a web prevents bypassing of the pumped fluid within the idler gear 28.

FIGURES 8 and 9 illustrate a further embodiment of the invention. In FIGURES 8 and 9 the housing is defined by plural housing sections 60 and 61 with the housing section 60 constituting the major portion of the overall housing. Housing section 60 includes a drive gear cavity 62 and an idler gear cavity 63. A bearing boss 64, which is formed from the material of section 60, projects into the drive gear cavity for supporting a drive gear 65 thereon. A drive shaft 66 is journaled for rotation in this bearing boss and is secured to a web 67 which is located at or near the center of the gear. The bearing boss 64 may include a recess 68 within which a packing ring 69 is seated so as to seal the drive shaft 66 with respect to the interior of the pump housing.

The idler gear 70 is supported on a bearing boss 71 which is of tubular form and which projects into the idler gear cavity. It should be noted that in FIGURE 8 the end face of the bearing boss 71 is substantially coplanar with the opposed face of the housing section 61. The housing section 61 may include a bearing boss 72 of tubular formation and which projects inwardly within the assembled housing in supporting relation to the drive gear 62. It should be understood that in some cases the bearing boss 72 may be omitted, in which case the bearing boss 64 may be extended further towards the section 61 with the web 67 of the drive gear also located more closely to the side of the drive gear adjacent to the housing section 61. In this connection, it should be noted that substantial support for the drive gear is provided by the support of the drive shaft 66 itself which, under some circumstances, may be sufficient for the support of the drive gear 65.

The idler gear 70 may have a thin web 70*a* closing the interior thereof and extending between the end face of boss 71 and the opposed surface of section 61. Such a web prevents bypassing of the pumped fluid within the idler gear.

The housing section 61 includes inlet and outlet ports 73 and 74 which communicate with fluid flow spaces on opposite sides of the meshing teeth of the drive and idler gears in a manner similar to the embodiment of FIGURES 1 through 6.

A gasket 75 is positioned between the opposed peripheral rims of the housing sections so as to insure a fluid tight housing when the housing sections 60 and 61 are drawn together.

The housing sections 60 and 61 each have flanges 76 and 77 at the sides thereof, with each pair of flanges at each side of the housing adapted to be aligned with one another in a manner similar to FIGURE 2. Metallic tubes 78 are press fitted within apertures in these flanges and with the ends thereof flared outwardly in a manner similar to the tubes 47 and 48 in FIGURE 6, whereby the tubes hold the respective housing sections in aligned, press fitting relation, while at the same time providing a convenient means for fastening the assembled housing to a support.

FIGURE 10 illustrates a drive gear and idler gear in meshing relation and especially adapted to avoid overheating of the pump assembly. In FIGURE 10, the drive gear 79 is illustrated in meshing relation with idler gear 80. The drive gear 79 includes ports 81 and 82 which lead from points on opposite sides of the web 83 to spaces between the teeth of the drive gear as appears in FIGURE 11. The idler gear 80 includes ports 84 and 85 which are spaced generally diametrically from one another and which pass through the wall of the idler gear in radial directions, thereby establishing communication between the internal generally cylindrical space of the idler gear and the spaces between the teeth of the idler gear. It is preferred to use several ports spaced laterally of the idler gear as appears in FIGURE 10.

When using the gears of FIGURES 10 and 11 fluid between the intermeshing teeth of the idler and drive gear may pass through the ports 81 and 82 and along the web 83 and along the opposed end faces of the bearing bosses for the drive gear, as, for example, along the opposed end faces of the bearing bosses 72 and 64 of FIGURE 8. The fluid may then pass along the upper portion of the bearing bosses as appears by the direction of the arrows of FIGURE 10 and thence to the upper housing space where the gear teeth propel this fluid, during rotation of the gear teeth, to the inlet flow space for the housing. Thus fluid is circulated from the inlet space and along the spaces between the bearing bosses and the supporting web of the drive gear and then returned to the inlet space, thus providing a cooling effect for the drive gear and for its supporting bearing bosses. Some fluid, of course, may pass along the lower portion of the bearing bosses appearing in FIGURE 8 and then return to the inlet space as appears by the arrows in FIGURE 10.

In similar fashion fluid under pressure between the meshing teeth of the gears may pass through the ports 84 and 85 and work along the bearing bosses for the idler gear to the lower portion of the pump housing appearing in FIGURE 8, thus providing a circulation of fluid around the supporting bearing boss or bosses for the idler gear and providing protection against overheating of the assembly due to friction developed during operation of the pump.

Under some circumstances it is advisable to use antifriction washers in the housing sections and positioned for engagement with the opposite end faces of the drive and idler gears. In these cases, relatively thin plastic "Teflon" washers, as appearing at 86 and 87 in FIGURES 12 and 13, may be positioned in grooves formed in the drive gear cavity and idler gear cavity. The washers may be positioned on one side only of the drive and

idler gear or may be positioned on each side thereof as appears in FIGURE 8 at **86** and **87**. The washers may be formed of bronze material or other material different from the material of the gears and housing.

In some cases it may also be advisable to utilize a sleeve of material dissimilar from the material of the housing and gears, as a bearing liner between the drive gear, idler gear and their respective supporting bosses. A sleeve of Teflon plastic or bronze material, such as is illustrated in FIGURE 14 at **88** may be fixed to the internal cylindrical walls of the drive and idler gears or may be fixed to the cylindrical bosses of the drive and idler gears. The use of such anti-friction bearing sleeves, when the housing sections, drive gear and idler gear, are formed from plastic such as Delrin, provides an advantageous bearing for the drive and idler gears. Anti-friction washers may also be provided between the web of the drive gear and the opposed faces of its supporting bosses.

In use, the pump housings herein disclosed may be fixed to a supporting wall surface by means of screws extending through the apertured ears and connecting tubes of the pump housing. The particular flanges for the pump housing provide adequate support for the housing in such a situation. The use of the apertured flanges or ears is also advantageous in that an L-shaped supporting bracket may be provided for the pump which bracket may form an upstanding stand for the pump and have leg portions secured to the flanges on opposite sides of the pump thereby easily enabling mounting of the pump above a horizontal supporting surface or attachment to a supporting surface positioned at an end of the pump rather than at the side of the pump.

The particular forms of pump housing illustrated herein are advantageous to a molding process. In this connection the housing sections require a relatively short draw in the molding process. The particular formation of the housing sections is also advantageous in that they provide relatively thin walled sections which are advantageous in terms of preventage of shrinkage in molded parts. The assembly requires no bolts or similar fasteners to assemble the housing sections together, the assembly operation requiring only insertion of the drive shaft and its drive gear in one housing section, slipping the idler gear over its supporting boss in that section, bringing the other housing section into general alignment and then precisely aligning the housing sections and securing them together through the use of tubes **47** and **48**.

The particular formation of pumps as described and illustrated herein are particularly advantageous from the standpoint of minimizing overheating. The walls of the housing sections, except for that minor portion having the support for the drive shaft, are of substantially the same thinness which aids in dissipation of heat from the entire pump. The bearings for the gears are cooled by the fluid being pumped. In this connection, some of the pumped fluid may work through the small tolerance spaces between the gears and supporting bosses in the form of the invention illustrated in FIGURES 1 through 5, the gears of FIGURE 10 being especially formed to augment this circulation. This cooling effect is made possible by the location of the bearing bosses inboard of the side walls of the gear cavities, as distinguished from conventional pump design wherein the bearings are located at positions outside of the gear cavities. The cooling effect is also enhanced by the relatively large bearing areas for the gears.

The location of the bearings is also advantageous from the standpoint of reducing the overall size of the pump. In the pump of the present invention, a large bearing area is provided for the gears, which is a much larger proportion of the overall exterior size of the pump than is the case where the gear bearings are positioned outboard of the gear cavities. In another sense, the location of the bearings results in a greater pump capacity per unit overall size or per unit of material required in the manufacture of the pump.

To further promote cooling, fins may be provided on the exterior walls of the housing, and particularly within the depressions of the bearing bosses. Since cooling fins are well known for their property of dissipating heat, they are not illustrated in the drawings.

Pumps of the type illustrated herein may be used without a lubricating oil or grease, thus the pumps are advantageously used in pumping fluid where contamination by a lubricant must be avoided.

In some cases it may be desired to insure fluid tightness of the assembled pump. In this event a seam may be welded around the periphery of the housing sections adjacent to the parting line of the sections, thus permanently securing the housing sections together.

The assembly requires no thrust absorbing bearing elements as is customary with most gear supporting assemblies. In this connection the idler gear is freely slidable on its supporting boss or bosses and lateral movement thereof is restricted only by the material of the housing sections, with or without the washers illustrated in FIGURES 12 and 13. The drive gear is similarly supported although the connection of the drive shaft with a source of power may of course entail a restriction of the lateral play in the drive gear.

Pumps of the type illustrated herein can be manufactured sufficiently inexpensively that it is economically feasible to replace a wornout pump with a new one rather than repair the same.

Whereas we have shown and described several operative forms of the invention it should be understood that this showing and description thereof should be taken in an illustrative or diagrammatic sense only. There are many modifications in and to the invention which will fall within the scope and spirit thereof and which will be apparent to those skilled in the art. The scope of the invention should be limited only by the scope of the hereinafter appended claims.

We claim:

1. A gear pump assembly including a pair of housing halves formed to cooperatively define a drive gear cavity, an idler gear cavity and inlet and outlet spaces on opposite sides of a common center line for said cavities, an idler gear journalled for rotation in said idler gear cavity and a drive gear journalled for rotation in said drive gear cavity, said halves having laterally extended flanges on each side of the housing and aligned on opposite sides of a plane of separation between said halves, and a hollow, open ended tube tightly received within apertures in each pair of aligned flanges for holding said halves in alignment, each tube having flared end portions bearing against the material of said flanges and thereby holding said housing halves in a tight fitting relation, said hollow, open ended tubes providing a mounting means for said assembly.

2. The structure of claim 1 characterized by and including an inlet port and an outlet port formed in one of said housing halves and communicating with said inlet and outlet spaces.

3. A gear pump assembly including a plurality of housing sections cooperatively defining a drive gear cavity, an idler gear cavity and fluid inlet and outlet spaces, a drive gear and an idler gear each having an internal cylindrical bearing wall, generally cylindrical and hollow bearing bosses projecting into said drive gear cavity and idler gear cavity from at least one of said sections, the internal wall of said drive gear being journalled on the bearing boss in said drive gear cavity and the internal wall of said idler gear being journalled and supported on the bearing boss in said idler gear cavity, movement of said idler gear in a direction parallel to the rotary axis thereof being restricted by contact with the housing sections.

4. The structure of claim 3 characterized by and in-

cluding anti friction washers positioned in said cavities on opposite sides of said gears.

5. The structure of claim 3 characterized by and including an anti friction sleeve positioned between the internal wall of said idler gear and the supporting wall of the bearing boss for said idler gear.

6. The structure of claim 3 wherein the internal cylindrical bearing wall for said idler gear extends from one side of said idler gear to the other.

7. The structure of claim 3 wherein each housing section has bearing bosses projecting into each cavity and the drive gear and idler gear have bearing walls journalled on each of said bosses.

8. A gear pump assembly including a plurality of housing sections having internal walls formed to cooperatively define a drive gear cavity, an idler gear cavity and inlet and outlet spaces, a drive gear in said drive gear cavity and an idler gear in said idler gear cavity, said drive gear and idler gear being supported for rotation on bearings positioned inwardly of the side walls of the sections defining said cavities, each of said sections and gears being made of plastic material, said drive gear having a drive shaft supported in one of said sections, said bearings being in the form of hollow bosses projecting inwardly from said sections, the material of said sections and bosses being of substantially the same wall thickness except in the region of said drive shaft.

9. A gear pump assembly including a plurality of housing sections having internal walls formed to cooperatively define a drive gear cavity, an idler gear cavity and inlet and outlet spaces, a drive gear in said drive gear cavity and an idler gear in said idler gear cavity, said drive gear and idler gear being supported for rotation on bearings, said bearings being positioned inwardly of the side walls of the sections defining said cavities, said drive gear having a drive shaft supported in one of said sections, said bearings being in the form of hollow bosses projecting inwardly from said sections, the material of said sections and bosses being of substantially the same wall thickness except in the region of said drive shaft.

10. The structure of claim 9 wherein said idler gear includes a thin web extending in the space between the idler gear supporting bosses, said web serving as a thrust bearing surface for said idler gear.

11. A gear pump assembly including plural housing sections cooperatively defining a gear pump enclosure with a drive gear cavity, an idler gear cavity and fluid flow spaces on opposite sides of a space for the meshing teeth of the drive gear and idler gear, at least one of said sections having hollow, generally cylindrical bearing bosses projecting into said drive gear cavity and idler gear cavity, the internal end of said bearing boss in said idler gear cavity being closed, the hollow portions of said bosses being open to the exterior of said section, a drive gear positioned in said drive gear cavity and an idler gear positioned in said idler gear cavity, said drive gear being positioned on a drive shaft received in the bearing boss in said drive gear cavity, said idler gear being journalled on said boss extending inwardly into said idler gear cavity, inlet and outlet means communicating with said fluid flow spaces, and means holding said sections together.

12. The structure of claim 11 wherein each section defines approximately one-half of the pump enclosure.

13. The structure of claim 11 wherein one section defines a major portion of the pump enclosure.

14. The structure of claim 11 wherein the wall of said one section is depressed inwardly to form a thin walled and hollow bearing boss for said idler gear.

15. The structure of claim 11 wherein said drive gear has a central web between generally cylindrical internal bearing walls, and said bearing walls are journalled on bosses projecting inwardly from each of said sections.

16. The structure of claim 11 wherein each section has an apertured mounting flange on opposite sides thereof and positioned for alignment with an apertured flange on the other section when the sections are in alignment, and a tube is positioned within the apertures of aligned flanges, the ends of each tube being flared and pressed against the material of said flanges to thereby hold said sections together.

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