

Dec. 20, 1949

S. V. E. TAYLOR

2,492,073

GEAR PUMP

Filed April 1, 1946

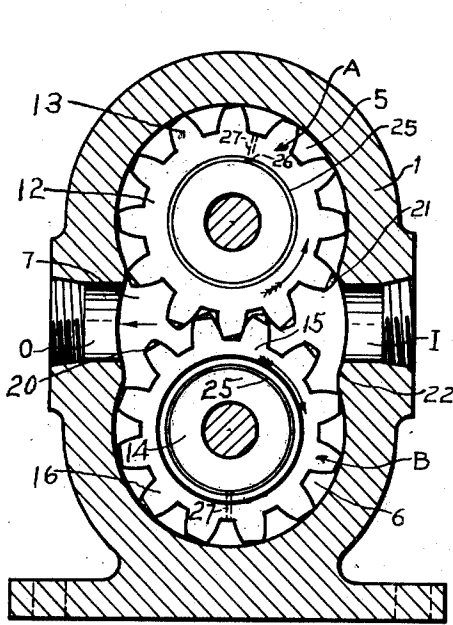


Fig 1

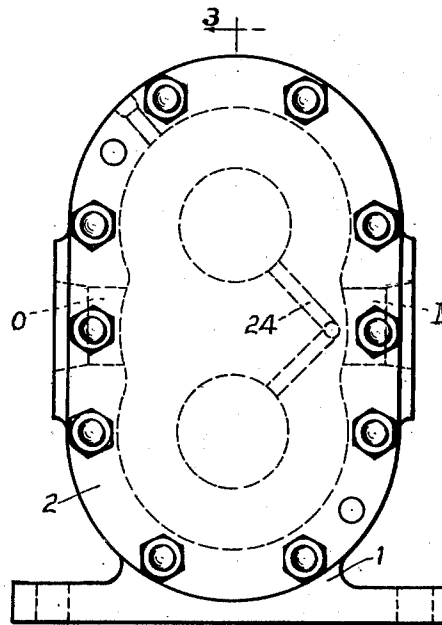


Fig 2

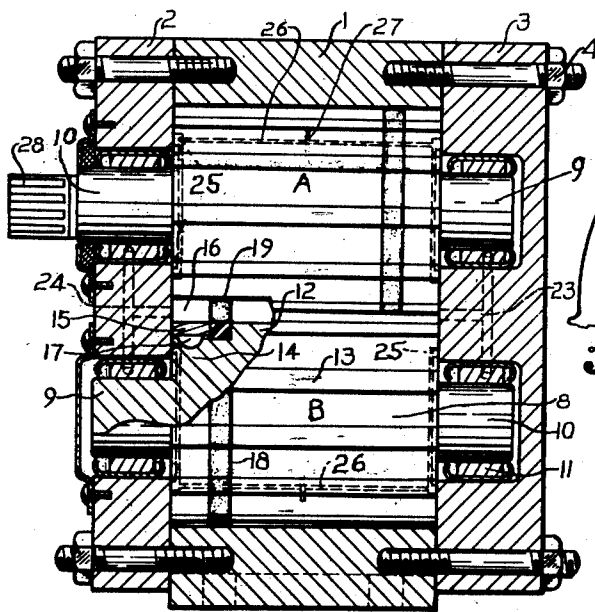


Fig 3

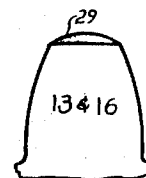


Fig 4

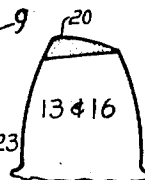


Fig 5

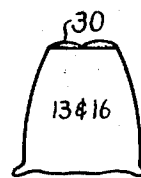


Fig 6

INVENTOR.
SCOTT V. E. TAYLOR
BY *P. V. Lamphear*
ATTORNEY

UNITED STATES PATENT OFFICE

2,492,073

GEAR PUMP

Scott V. E. Taylor, Cleveland, Ohio

Application April 1, 1946, Serial No. 658,768

15 Claims. (Cl. 103—126)

1

This invention relates to pumps and more particularly to improvements in pumps of the gear type.

One of the objects of the invention is to produce a gear type pump which will be substantially leak proof in operation.

Another object is to so construct a leak proof gear pump that wear of the parts will be automatically compensated for by a self-adjusting operation.

A further object is to produce a gear pump wherein the teeth of each gear are so constructed as to be capable of sealing engagement with the companion gear and also with the wall of the pump bore.

A still further object is to so construct a leak proof gear pump that stock gears need only be used, thus not requiring close tolerances during manufacture.

A further object is to produce a pump of the gear type which is quiet in operation, has improved volumetric and overall efficiency and is economical to manufacture.

A more specific object is to produce a gear pump in which leakage between the meshing teeth, the teeth and the surfaces of the bores and between the end surfaces of the gears and the bore end walls is substantially eliminated by the employing of resilient material such as rubber or synthetic rubber-like material at selected points in the gears.

A further object is to produce an improved gear tooth structure for a gear pump.

Other objects of the invention will become apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a vertical sectional view through a gear pump embodying my invention, the gears being shown in full and their shafts removed;

Figure 2 is an exterior side view of the pump;

Figure 3 is a section view taken on the line 3—3 of Figure 2, with one of the gears shown in full lines and the other gear with parts broken away to show details of construction;

Figure 4 is an enlarged side view showing a tooth construction; and

Figures 5 and 6 are enlarged views showing other tooth constructions that can be employed.

Referring to the drawings in detail and first to Figures 1 to 4, inclusive, the general construction of my improved gear pump is of standard design. It has a casing structure comprising a main casing member 1, to the ends of which are secured end plates 2 and 3 by means of bolts 4. Suitable

2

gaskets can be provided between the end plates and casing member 1 to prevent leakage. The main casing member 1 is provided with two bores 5 and 6 having parallel axes so spaced that the bores intersect to provide a common chamber 7. This common chamber has an inlet port "I" and an outlet port "O." The moving parts of the pump comprise the two gears "A" and "B," the former being mounted for rotation in the bore 5 and the latter in the bore 6. The two gears are of like construction and are arranged to be in meshing engagement within the common chamber 7, to thus provide a suction compartment adjacent the inlet and a compression compartment adjacent the outlet, as is well known. Since the gears are of like construction, only one will be described in detail with the same reference characters employed to indicate like parts of each gear.

Each gear has a main section 8 of an axial length to fit between the end plates. Extending from each end of this main section are integral journals 9 and 10 whereby the gear can be mounted for rotation in the end plates 2 and 3 by means of suitable bearings 11. A major portion 12 of this main section is provided with integral teeth 13 and the remaining portion 14 is of reduced diameter and free of teeth. On this reduced portion is mounted an annular or ring section 15 which is provided with integral teeth 16, said teeth being of the same number and of like size and shape as the teeth 13 on the main section. The ring 15 is secured to the main section by a key 17 so the two sections form a unit. The axial length of the ring section is less than the length of the reduced portion 14 on the main section so that when the ring 15 is mounted on the end of the reduced portion of the main section, there will be available a space between the main section and the ring. This space is arranged to be filled by resilient material which will be in the form of a ring or washer 18. The resilient ring is preferably of rubber or a synthetic rubber-like material having the desired characteristics as to resiliency, expansion and contraction due to changes in temperature, wearability, friction, resistance to deterioration by pumped fluid, etc. I have found that a synthetic rubber-like material such as acrylo-nitrile rubber cork composition is a satisfactory material, but it is obvious that other materials which may be compounded from natural rubber or synthetic rubber-like material may also be used.

The resilient ring or washer 18 has, on its periphery, teeth 19 which are of the same number and conform to the shape and size of the

teeth on the two sections 12 and 16. The resilient material is first assembled on the main section and then the ring section 15 secured in place on the reduced portion of the main section. After this assembly operation the resilient material is bonded in a vulcanizer to the engaged surfaces of the main section and the ring section of the gear. When the two sections of the gear and the interposed resilient material are assembled, the overall length of the gear should be slightly greater than the distance between the end plates.

The integral teeth 13 and integral teeth 16 of the two sections forming the gear are also to be tipped with a resilient material 20, best shown in Figure 4, which is an enlarged side view of one of these teeth. The resilient material 20 is placed on the outer or top end surface only of the tooth and, as shown in Figure 4, is of general wedge shape cross section. The resilient material of the tip can be rubber or a synthetic rubber-like material and is preferably the same material as the resilient material of the ring or washer 18 between the two gear sections. The tip 20 of resilient material is bonded on the end surface of the teeth. This bonding can be done at the same time that the resilient washer 18 is bonded to the two gear sections.

The gears A and B constructed in the manner described are mounted in the bores and journaled in the end plates in such a manner that the thin or tip edge of the wedge shaped resilient gear tooth ends will be at the rear side of the teeth with respect to the direction of rotation of the gears. This arrangement of the gears in the bores is shown in Figure 1 wherein it is to be noted that the direction of rotation of the gears will be as indicated by the arrows. With such a mounting of the gears the resilient washers 18, which are interposed between the sections of the gears, will be in axially spaced relation as indicated in Figure 3. This results in no resilient material of one gear operating against resilient material of the other gear and consequently saving in power and keeping heating at a minimum. When the teeth of the gears are provided on their top ends with the resilient material 20, they will have an overall diameter, measured from the outermost surface of the resilient tips, which will be slightly greater than the diameter of the bore in which the gear is to rotate. With this relationship between the over-all diameter of the gear and the diameter of the bore, it will be seen that when the gear is mounted in bore the resilient material on the ends of the teeth of the gears will be slightly compressed, thus insuring that there will be a sealing action between the ends of the teeth and the surfaces of the bores. As a result of this resilient material on the ends of the teeth, together with the resilient material embodied in the gears between the two sections, there will be produced a substantially leak proof gear pump. The end face surfaces of the gears will at all times be maintained in a slight pressure engagement with the surfaces of the end plates, thereby eliminating any leakage around the ends of the gears. The resilient tips will insure that no fluid will leak by the ends of the teeth when they are cooperating with the surfaces of the bores. There will also be no leakage between the meshing teeth as, under such conditions, the resilient tips will engage the surface of the gears at their base circles and thus produce a sealing action. If the end faces of the gears or the surface of the end plates should wear slightly during operation of the pump, this wear will be compensated for by ex-

pansion of the resilient washer or ring 18 which is under compression. In order that the resilient tips can smoothly enter the bores during rotation of the gears the casing member 1 has curved surfaces 21 and 22 as shown in Figure 1.

In order that the pump may be properly lubricated, the suction compartment adjacent the inlet side of the pump communicates with suitable passages 23 and 24 in the end plates which lead to the bearings of the various journals. It is also desirable to lubricate the end faces of the gears to prevent excessive wear and decrease friction and to accomplish this each end face of the gear is provided with annular grooves 25. These grooves are placed in communication with each other by means of a small passage 26 which is bored axially through the main section 12 of the gear. To supply lubricant to the passage 26 so it can flow to the end grooves, there is provided a radial passage 27 which opens into the space between two teeth 13 at the base circle of the gear. Thus, upon each rotation of the gears, lubricant will be forced into the passage 27 by a tooth and from the passage 27 it can flow or be forced to the annular end grooves by way of the axial passage 26, thus insuring that lubricant will be supplied to the end faces of the gears. The lubricating system shown for the pump is primarily designed for the pump when employed in pumping a lubricant, such as oil. If the pump should be used for pumping a fluid which has no lubricating characteristics, then other lubricating arrangements can be made.

In order that the gear pump can be driven from an external source of power, one of the journals, such as the journal 10 of gear A, can be provided with a splined extension 28 to which a pulley or some other driving element can be readily attached.

The wedge shape of the resilient tip 20 for the gear teeth is a preferable shape for some uses, but other shaped tips can be employed. For example, the resilient material may have a cross section similar to the tip 29 shown in Figure 5. This tip, as shown, provides a convex outer surface on the tip with its greatest thickness at the center of the tooth. In Figure 6 another shape of resilient tip for the teeth is shown. The cross-sectional shape of this tip 30 is such that it has two outer convex surfaces which intersect along a central longitudinal line. The resilient tips shown in both Figures 5 and 6 are so shaped that they will have the same sealing action, regardless of which direction the gears rotate, whereas the tip 20 is primarily designed for a single direction of rotation of the gears.

Being aware of the possibility of modifications in the particular structure shown, without departing from the fundamental principles of my invention, I do not intend that the scope of the invention be limited except in accordance with the appended claims.

What is claimed is:

1. In a gear pump, a casing structure having gear receiving bores and an inlet and outlet, and intermeshing gears journaled in the casing and positioned in the bores, each of said gears being provided on the top ends only of their teeth with resilient material bonded to the top surfaces of said ends, the normal over-all diameter of each gear including the teeth being slightly greater than the diameter of the casing bore in which it is positioned and the axes of the gears being so related that the resilient material on each tooth end of a gear will be compressed and thereby

5

having pressure engagement with a cooperating part of the other gear during meshing.

2. In a gear pump, a casing structure having gear receiving bores, an inlet, an outlet and end walls, meshing gears journaled in the bores, each of said gears comprising two toothed sections made from rigid material and provided with outer end face surfaces of the same rigid material engaging end walls of the casing, and resilient material interposed between said sections, the interposed material of each gear being compressed in the axial direction of the gear when the gear is mounted in a casing bore with the outer end surfaces of the sections engaging the end walls and said interposed material having an outer peripheral surface conforming to that of the sections.

3. In a gear pump, a casing structure having gear receiving bores, end walls and an inlet and outlet, intermeshing gears journaled in the casing and positioned in the bores, each of said gears being provided on the top ends only of their teeth with resilient material bonded to the top surfaces of said ends and unsupported laterally of its edges by gear tooth material, the normal over-all diameter of each gear including the teeth being slightly greater than the diameter of the casing bore in which it is positioned and the axes of the gears being so related that the resilient material on each tooth end of a gear will be compressed and thereby having pressure engagement with a cooperating part of the other gear during meshing, and resilient means so embodied in the gears between the ends thereof as to permit the end surfaces of the gears to have yieldable relative movement in an axial direction, each of said gears with the last named resilient means having a normal over-all axial length slightly greater than the distance between the end walls of the casing structure.

4. In a gear structure comprising two gear sections of rigid material each having integral teeth and a flat end face of said rigid material for engaging an end wall surface of a casing, said sections being secured together with adjacent inner ends in spaced relation, and resilient material interposed between the adjacent inner ends only of the sections and having an outer peripheral surface conforming to that of the sections, the overall axial length of the sections and the interposed resilient material being slightly greater than the distance between end wall surfaces of a casing which is to be engaged by the flat end faces.

5. In a gear structure comprising two gear sections of rigid material each having integral teeth and a flat end face of said rigid material for engaging an end wall surface of a casing, said sections being secured together with adjacent inner ends in spaced relation, resilient material interposed between the adjacent inner ends only of the sections and having an outer peripheral surface conforming to that of the sections, and resilient material bonded to the top end surfaces only of the integral teeth of each section.

6. A gear structure for a gear pump, said gear structure comprising a main gear section of rigid material provided with a portion having integral teeth and a portion of reduced diameter free of teeth, an annular section having teeth corresponding to the teeth of the main section and being mounted on the reduced portion of the main section for rotation therewith, resilient material positioned between the two sections to thereby permit limited relative movement therebetween in an axial direction, and resilient material secured to and carried by the top end surfaces only of the teeth of both sections.

6

7. In a gear structure, a gear body of rigid material having teeth, and resilient means secured to and carried by the top end surface only of each tooth and being unsupported laterally of its edges by rigid tooth material.

8. In a gear structure, a gear body of rigid material having teeth, and resilient material bonded to the top end surface of each tooth, said resilient material extending from the end surface of the tooth in an outward radial direction and being unsupported at its edges by rigid tooth material.

9. In a gear structure, a gear body of rigid material provided with integral teeth, and resilient material secured to top end only of each tooth, said resilient material being of greater cross-sectional thickness in a radial direction of the gear at one point than at other points.

10. In a gear structure, a gear body of rigid material provided with integral teeth, and resilient material secured to top end only of each tooth, said resilient material being of general wedge shape in cross-section with the tip portion of the wedge extending toward the rear side of the tooth when considered with respect to the direction of rotation of the gear.

11. In a gear structure, a gear body of rigid material provided with integral teeth, and resilient material secured to the top end only of each tooth, said resilient material having the greatest thickness at its center in a radial direction of the gear and being of gradually lesser thickness toward the ends thereof.

12. In a gear structure, a gear body of rigid material provided with integral teeth, and resilient material secured to the top end only of each tooth, said resilient material having two curved outer surfaces which intersect adjacent the central part of the end of the tooth.

13. In a gear structure, a gear body of rigid material provided with integral teeth, and tips of resilient material bonded to the outer end surfaces of the teeth and being unsupported laterally of its edges by rigid tooth material, said resilient material being an acrylo-nitrile rubber cork composition.

14. A gear structure for use in a gear pump casing having end walls comprising a main gear section made of rigid material and having a portion of its axial length provided with integral teeth and the remaining portion of its length of reduced diameter, a ring section secured to the reduced portion and provided with integral teeth of the same size and number as the main section, and an annular member of resilient material interposed between the inner end of the ring section and the end surface of main section formed by the reduced portion to thereby permit the sections to have their ends in pressure engagement with end walls of a pump casing when placed therein and the end walls of said casing are so spaced apart as to be slightly less than the normal overall length of the sections and interposed material, said annular member of resilient material having peripheral teeth to conform in shape with the teeth of the sections and being interposed between the adjacent ends of the teeth of the sections.

15. In a gear pump, a casing structure having gear receiving bores, an inlet, an outlet, and end walls, meshing gears journaled in the bores, each of said gears comprising two sections of different axial widths made from rigid material and provided with outer end faces of the same rigid material for engaging the end walls of the casing, and resilient material interposed between said

sections, the interposed material of each gear being compressed in the axial direction of the gear when the gear is mounted in a casing bore with the outer end surfaces of the sections engaging the end walls and said interposed material having an outer peripheral surface conforming to that of the sections, said gears being so positioned with respect to each other that the interposed resilient material of one gear will lie in a plane different from the plane of the interposed material of the other gear.

SCOTT V. E. TAYLOR.

REFERENCES CITED

The following references are of record in the file of this patent:

15

Number
10,409

UNITED STATES PATENTS

Number	Name	Date
1,191,907	Northrup	July 18, 1916
1,334,906	Keith	Mar. 23, 1920
1,369,073	Auger	Feb. 22, 1921
1,407,496	Storey	Feb. 21, 1922
1,582,922	Freud	May 4, 1926
1,712,157	Morita	May 7, 1929
2,093,420	Creager	Sept. 21, 1937
2,344,628	Monahan	Mar. 21, 1944
2,383,194	Giloes	Aug. 21, 1945
2,391,072	Pugh	Dec. 18, 1945
2,403,796	Hanna	July 9, 1946

FOREIGN PATENTS

Country	Date
Great Britain	Aug. 10, 1895