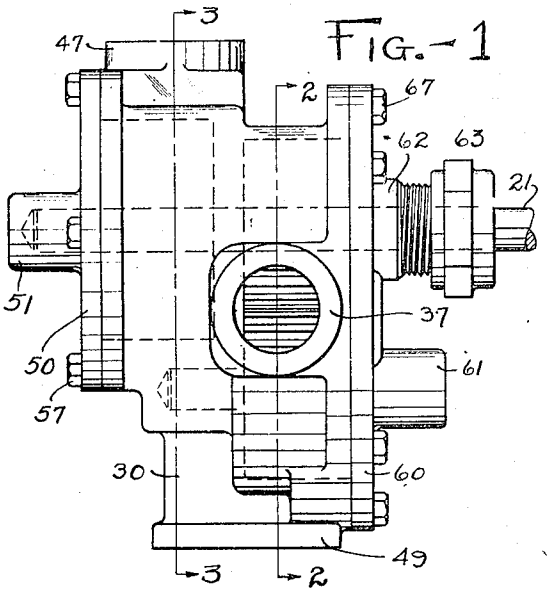
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PUMP

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FIG.-1



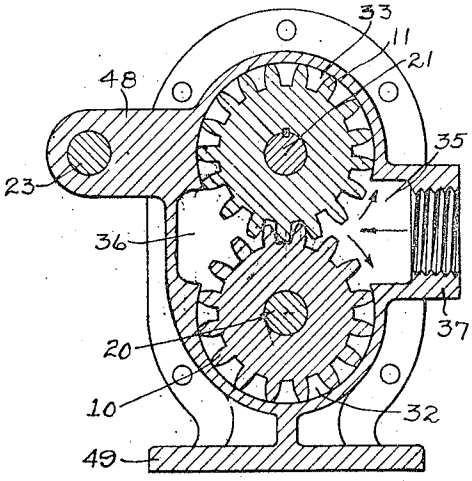


FIG.-2

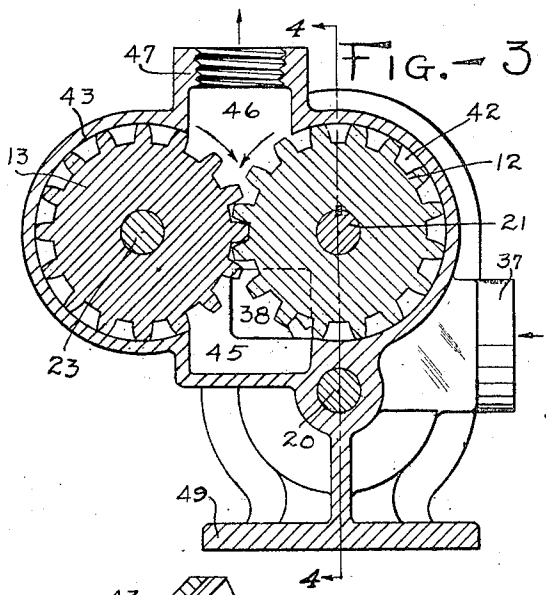


FIG.-3

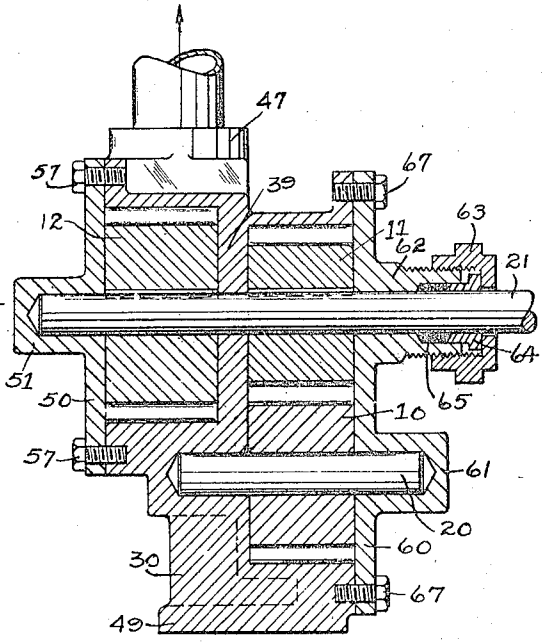


FIG.-4

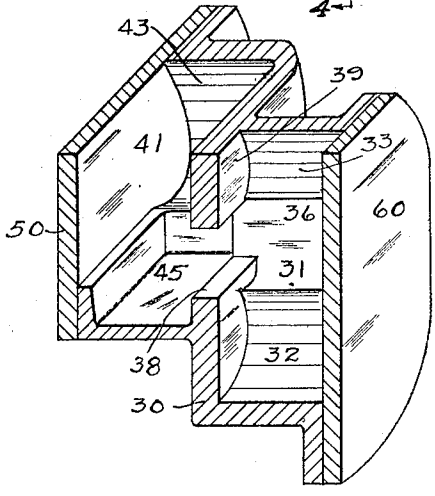


FIG.-5

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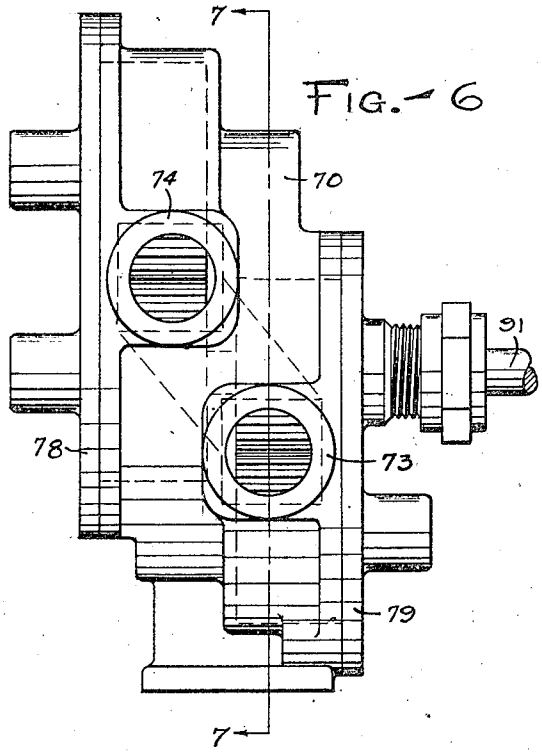


FIG. 6

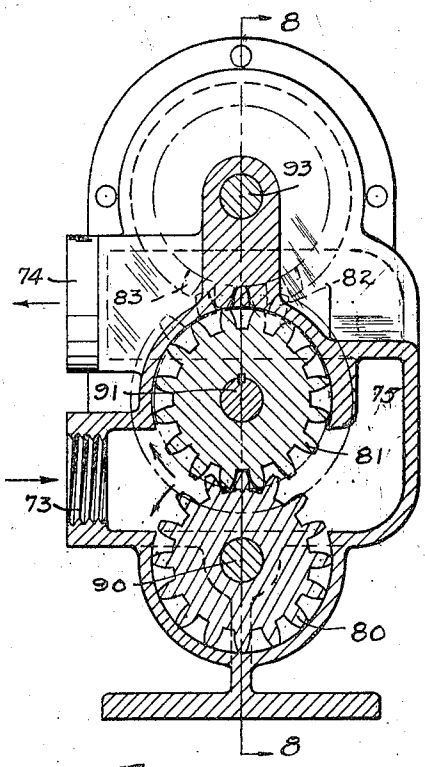


FIG. 7

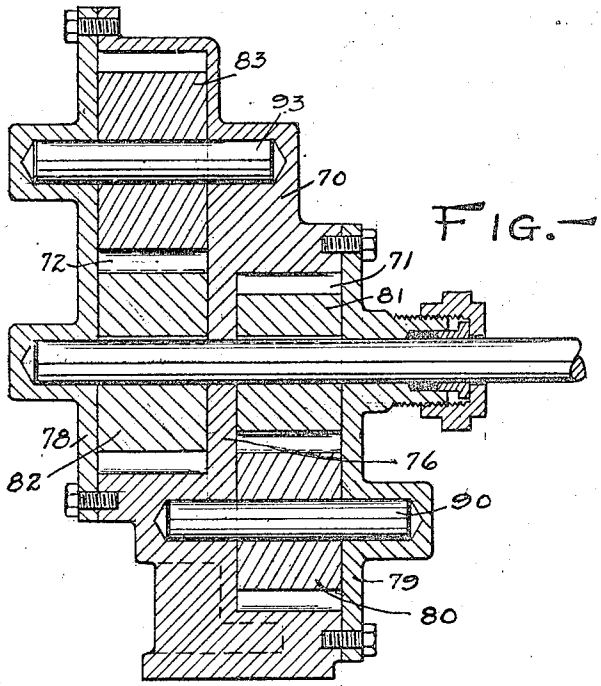


FIG. 8

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UNITED STATES PATENT OFFICE

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PUMP

Application filed January 11, 1928. Serial No. 245,817.

This invention relates to a rotary pump of the type employing meshing gears to act as impellers, forcing the fluid through the pump. One of the disadvantages commonly encountered in such pumps is the difficulty in starting the pumping action unless the pump is primed, because unless the working joints are sealed by liquid, very little vacuum is produced. It is the object of my invention to improve the pump in the matter of producing a better vacuum and enabling it to operate more readily without priming. I accomplish this primarily by placing two or more pairs of gears or rotors in series so that the discharge from one pair will constitute the intake supply for the succeeding pair. Thus, all leakage must pass through the entire series before it can affect the vacuum produced.

I arrange each pair of gears in its own chamber, and I mount the final gear of one pair on the same shaft with the first gear of the next pair, and thus produce a continuous train of gears that can be driven from a single shaft.

Another feature of my invention comprises making each succeeding pair of gears of greater capacity than the preceding pair in the series, with the result that each succeeding pair produces some additional vacuum between it and the preceding pair, and thus reduces the leakage back through such preceding pair. This increased capacity may be made by having the gears of larger diameter or greater length of tooth. The increase is preferably only sufficient to slightly more than overcome the leakage past that pair of gears.

I have illustrated in the drawings two embodiments of my invention, each of which has two pairs of gears. These are to be taken as illustrations of any number of succeeding pairs, each subsequent pair of which receives the discharge from the preceding pair.

In the drawings, Figs. 1 to 5 inclusive show an embodiment of the pump wherein the first pair of gears have their axes in a vertical plane, and a second pair in a horizontal plane; Figs. 6 to 8 show an embodiment where both pairs of gears have their axes in the same vertical plane.

Fig. 1 is a side elevation of the first type of pump; Figs. 2 and 3 are vertical sections thereof on the lines 2—2 and 3—3 respectively on Fig. 1; Fig. 4 is a vertical transverse section through the first pair of gears as illustrated by the line 4—4 on Fig. 3; Fig. 5 is a section of a perspective of the casing shown in the preceding figures; Fig. 6 is a side elevation of the second embodiment of the pump; Fig. 7 is a vertical section thereof on the plane indicated by the line 7—7 on Fig. 6; Fig. 8 is a vertical section at right angles to Fig. 7 as indicated by the line 8—8 on Fig. 7.

Referring first to the embodiment shown in Figs. 1 to 5 inclusive, 10 and 11 indicate the first pair of gears shown, and 12 and 13 the second pair. The gear 10 is mounted on an individual shaft 20; gears 11 and 12 are keyed to a common shaft 21, and the gear 13 is mounted on an individual shaft 23. A casing is provided which furnishes two separate but communicating chambers for the two pairs of gears, and furnishes also the bearings for the shafts. This casing will now be specifically described.

The casing of Figs. 1 to 5 inclusive may comprise a single suitably formed casting 30 and a pair of side plates 50 and 60. The casting 30 has an internal chamber 31 of vertically elongated form, being semi-cylindrical at its lower portion 32 and semi-cylindrical at its top portion 33, and intermediately recessed outwardly by two recesses 35 and 36 which are on opposite sides of the meshing region of the gears 10 and 11. The recess 35 constitutes the intake passageway, and the wall of the casing about it may be extended by a tubular portion 37, suitably threaded to enable the intake pipe to be coupled to it. The opposite recess 36 leads horizontally through an opening 38 in an internal partition of the casting into the chamber for the second pair of gears.

The chamber for the second pair of gears designated 41 is, in this embodiment, horizontally extended, being substantially semi-cylindrical at its two ends 42 and 43, and inter-

mediately widened by two recesses 45 and 46. The recess 45 is below the meshing region of the two gears 12 and 13, and communicates through the opening 38 with the chamber of the first pair. The recess 46 constitutes the discharge passageway of the second pair. It is shown as leading to an ultimate discharge, being surrounded by a tubular wall 47 threaded to receive a discharge pipe, but if desired, it may communicate with a third pair of gears, it being understood that the number of succeeding pairs may be continued as desired.

The side plate 50 closes the outer side of the chamber 41 and has hollowed bosses to form bearings at that end for the shafts 21 and 23. One of these bosses is shown at 51 in Figs. 1 and 4, and the other boss may be just like it and located behind it. This side plate may be readily secured in place by cap screws 57. The other end of the shaft 23 may be carried in a suitable arm 48 of the casing as shown in Fig. 2.

The other side plate 60, held in place on the casting by cap screws 67, closes the chamber 31 of the first pair of gears. It has a hollow boss 61 to form one bearing for the shaft 20, the other bearing of which is in the casing casting itself. This side plate 60 also has a hollow boss 62 forming the other bearing for the shaft 21. This boss may be readily extended to form a stuffing box, a suitable nut 63 screwing on to it, and being adapted to force inwardly a bushing 64, which compresses a packing 65. This allows the shaft 21 to extend outside the pump and receive a suitable driving pulley or gear not shown.

It will be seen that the casing is a very simple structure comprising simply the main casting member and its side plates. This main casting may be readily formed at its lower end into a suitable base 49 adapted to support the pump. In the specific embodiment shown, when pipes are attached to the extensions 37 and 47 and power applied to the shaft 21, liquid will be pumped from the intake pipe and discharged upwardly through the outlet pipe.

It will be seen that the pair of gears 12 and 13 in the embodiment described are of larger diameter than the gears 10 and 11. Those gears, however, by reason of the common shaft 21, make the same number of rotations as the gears 10 and 11. Accordingly, the larger gears 12 and 13 tend to produce a vacuum in the passageways 45, 38 and 36 between them and the first pair of gears, and this augments the suction impulse made by the first pair of gears, and tends to prevent the leakage from the second pair passing back through the first pair.

In the embodiment shown in Figs. 6 to 8, the operation is similar to that described, but in this case the second pair of gears is mounted in the same vertical plane with the first pair, which requires corresponding changes in the form of the casing and produces a pump somewhat higher and narrower. As the effective operation is the same as the first embodiment, it will only be necessary to briefly describe the construction shown in these figures. Such construction comprises the main frame casting 70 having a chamber 71 for the first pair of gears; a chamber 72 for the second pair; and intake passageway 73 to the first pair and a discharge passageway 74 from the second pair, and an internal communicating passageway 75 from the discharge side of the first pair to the intake side of the second pair, this passageway leading through a partition 76 of the casting between the two chambers. Side plates 78 and 79 complete the casing.

In the second embodiment, the first gear 80 is mounted on a shaft 90 journalled in the main casting and the plate 79. The meshing second gear 81 is keyed on the common shaft 91 journalled in the frame plates 78 and 79. The first gear 82 on the succeeding pair is also keyed on this shaft 91, while the final gear 83 of that pair is mounted on an individual shaft 93 journalled in the plate 72 and in the main casting. The three shafts, 90, 91 and 93, are in this case all located in one vertical plane. The pair of gears 82 and 83 are of larger diameter than the gears 80 and 81, for the reasons heretofore explained.

I claim:

1. In a pump, the combination with a casing, of a plurality of pairs of rotary impellers, each pair comprising two meshing members mounted in their own chamber, the chamber of one pair communicating with the chamber of the succeeding pair by a passageway within the casing, and means for rigidly connecting the final gear of one pair with the first gear of the succeeding pair to compel them to rotate as a unit.

2. In a pump of the character described, the combination with a casing having individual chambers, pairs of meshing gears in the respective chambers, the chamber of each pair communicating with the chamber of the next pair by a passageway within the casing, shafts for supporting said gears, the final gear of one pair and the first gear of the next pair being rigidly mounted on a common shaft.

3. In a rotary pump, the combination with a suitable casing having a plurality of chambers, each substantially semi-cylindrical at its ends and laterally recessed at opposite sides, and a pair of gears in each chamber making a close connection with the semi-cylindrical walls of the chamber and meshing in the region of said recesses, one of such recesses constituting an intake and the other a discharge, and the discharge recess of one chamber communicating through an internal par-

tition of the casing with the intake of a succeeding chamber.

4. In a pump, the combination with a suitable casing, having a plurality of chambers, each substantially semi-circular at its ends and enlarged intermediately at opposite sides, a pair of gears in each chamber making a close connection with the semi-circular wall of the chamber and meshing in the region between said enlargements, one of such enlargements constituting an intake and the other a discharge, and the discharge of one chamber communicating with the intake of a succeeding chamber, and a common shaft on which the final gear of the first pair and the first gear of the second pair are rigidly mounted.

5. In a rotary pump with toothed rotary impellers of the meshed pair type, the combination of an operating shaft with two or more impellers mounted on it and fixed to rotate with it, each having a cylinder within which it rotates and each having another impeller mounted within the cylinder to mesh with it, a partition wall separating each cylinder from the other between the impellers on the operating shaft, the operating shaft passing through said wall, each cylinder having within it an inlet and an outlet space, an outlet port from the first cylinder outlet space through the partition into the second cylinder inlet space, another outlet port from each succeeding cylinder through the partition to the inlet space of the adjacent cylinder, and means for rotating the operating shaft.

6. In a pump of the character described, the combination with a casing having at least two chambers communicating with each other, an inlet leading to the first chamber, and an outlet leading from the second chamber, a pair of meshing gears in the first chamber, a pair of meshing gears of larger diameter in the second chamber, and a common shaft on which the final gear of the pair in the first chamber and the first gear of the pair in the second chamber are both rigidly mounted.

7. In a rotary pump, the combination with a suitable casing having a plurality of chambers, each substantially semi-cylindrical at its ends and laterally recessed at opposite sides, and a pair of gears in each chamber making a close connection with the semi-cylindrical walls of the chamber and meshing in the region of said recesses, one of such recesses constituting an intake and the other a discharge, and the discharge recess of one chamber communicating through an internal partition of the casing with the intake of a succeeding chamber, each succeeding pair of gears having a greater volumetric capacity than the preceding pair, and means for rigidly connecting the final gear of each pair with the first gear of the succeeding pair.

8. In a rotary pump with toothed rotary impellers of the meshed pair type, the combination of an operating shaft with two or more impellers mounted on it, and fixed to rotate with it, each having a cylinder within which it rotates and each having another impeller mounted within the cylinder to mesh with it, a partition wall separating each cylinder from the other through which the operating shaft passes, each cylinder having within it an inlet and an outlet space, an outlet port from the first cylinder outlet space through the partition to the inlet space of the second cylinder and so on between all cylinders of the series, one or more of each succeeding pair of impellers having a volumetric capacity for pumping greater than the preceding pair so that a partial vacuum is produced in the passageway from one to the other with means for rotating the operating shaft.

9. In a pump, the combination with intake and discharge passageways, of two pairs of impellers, the second impeller of the first pair being coaxial with the first impeller of the second pair, a common shaft on which the coaxial impellers are mounted, and a partition between such coaxial impellers having a port through it.

10. In a pump, the combination of two pairs of impellers, the second impeller of the first pair and the first impeller of the second pair being coaxial and rigidly connected, the plane connecting the axes of the first pair of impellers being at right angles to the plane connecting the axes of the second pair, a casing housing both pairs and having an intermediate partition with cavities on opposite sides thereof, one pair of impellers being in one cavity and the other pair being in the other cavity, and there being a passage through the partition which constitutes a discharge for the first pair and an intake for the second pair.

11. In a pump, the combination of two pairs of impellers, the second impeller of the first pair and the first impeller of the second pair being coaxial, a casing housing both pairs and having an intermediate partition with cavities on opposite sides thereof, one pair of impellers being in one cavity and the other pair being in the other cavity, and there being a passage through the partition which constitutes a discharge for the first pair and an intake for the second pair, cover plates on the outside of the casing closing the cavities respectively, the coaxial impellers being mounted on a common shaft journalled in said cover plates.

12. In a pump, the combination of two pairs of impellers, the second impeller of the first pair being coaxial with the first impeller of the second pair, a common shaft on which the coaxial impellers are mounted, a partition between such coaxial impellers, a port through said partition, the second pair of

impellers have a greater volumetric capacity than the first, and an intake port leading to the first pair and a discharge port leading from the second pair.

13. In a pump, the combination with a casing, two pairs of impellers within the casing, the second impeller of the first pair and the first impeller of the second pair being coaxial and mounted on a common shaft, the plane connecting the axes of the first pair of impellers being at right angles to the plane connecting the axes of the second pair, the casing having an intermediate partition with cavities on opposite sides thereof, one pair of impellers being in one cavity and the other pair being in the other cavity, and there being a passage through the partition which constitutes a discharge for the first pair and an intake for the second pair, cover plates on the outside of the casing closing the cavities respectively, the coaxial impellers being mounted on a common shaft journalled in said cover plates and the second pair of impellers being of larger volumetric capacity than the first pair whereby said second pair tends to create a vacuum in the space between the pairs.

14. In a pump, the combination of a casing having a plurality of chambers in parallel planes spaced apart, and a plurality of pairs of impellers, each pair comprising two meshing members mounted in their own chamber, the chambers being on opposite sides of an internal partition located between said planes, the discharge side of one chamber communicating by a passageway through the partition with the intake side of the succeeding chamber.

In testimony whereof, I hereunto affix my signature.

ALFRED RANDOLPH.