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BELLOWS AIR PUMP

Filed March 17, 1961

2 Sheets-Sheet 1

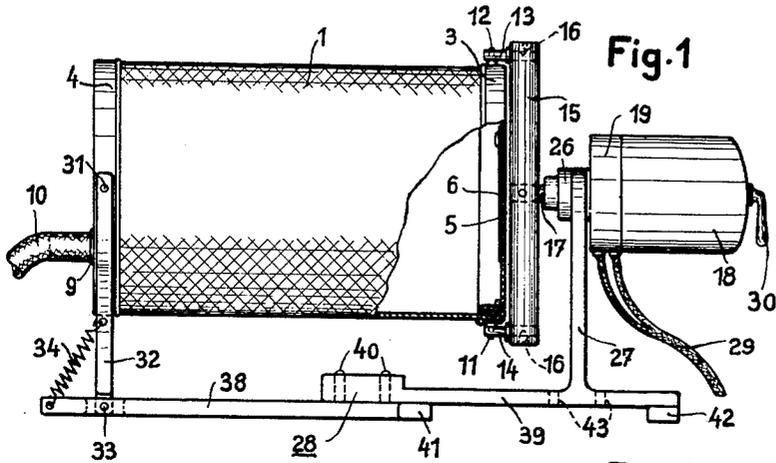


Fig. 1

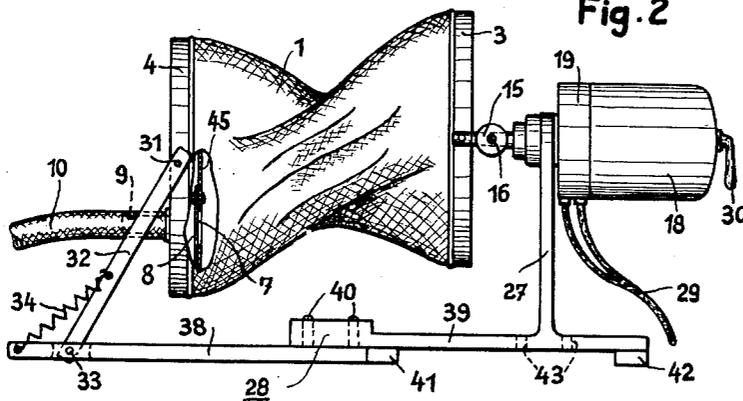


Fig. 2

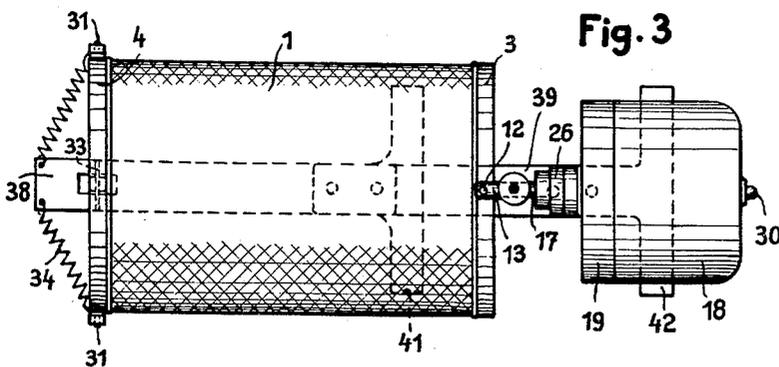


Fig. 3

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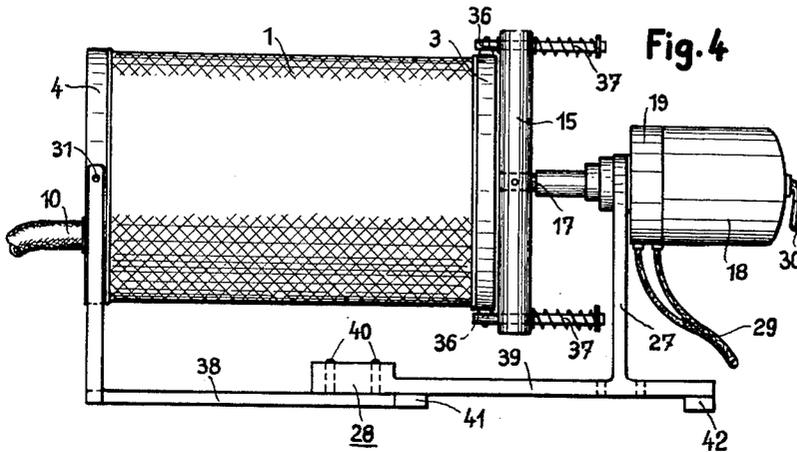


Fig. 4

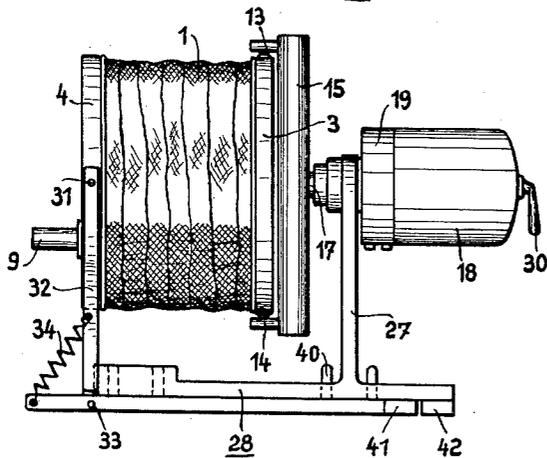


Fig. 5

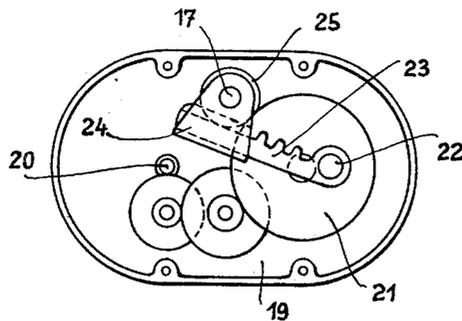


Fig. 6

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BELLOWS AIR PUMP

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 9 Claims. (Cl. 230-160)

The present invention relates to an air pump with a cylindrical bellows, and it is the primary object of the invention to provide a pump of this type which is easily transportable, adapted to be driven by a motor, and to be operated continuously, inexpensive in production and maintenance, and especially suitable for use in sports, camping, fishing, or for similar purposes.

For blowing up air mattresses, pneumatic boats, air pillows, swimming rings, and the like, as well as camping equipment of various kinds, it is conventional to use air pumps with hemispherical or cylindrical bellows which are operated by foot. Although this is a tiresome operation even with smaller articles, it requires a very great effort as well as considerable time to pump up a larger article by foot, for example, a pneumatic boat. These disadvantages may be avoided by means of a bellows pump according to the invention which is adapted to be driven by a small electric motor which may, for example, be connected to the starter battery of an automobile so that the pump may then even be used in a continuous operation, for example, for aerating tanks for trout and other kinds of fish which, after being caught, will die quickly unless they are kept in tanks in which the water is frequently or continuously aerated.

An essential feature of the present invention consists in mounting the bellows of the air pump at both ends in cylinder covers which are provided with valves and one of which is adapted to reciprocate by turning back and forth about its own axis at an angle of, for example, 100°, while the same or the other cover is resiliently movable in the axial direction.

The reciprocating cylinder cover of the bellows is preferably mounted on a crossbar which is secured to the driveshaft of an eccentric gear unit which is driven by an electric motor to produce the desired reciprocating movement.

Since the bellows is shortened when being twisted, either the reciprocating cylinder cover is supported on its mounting bracket by means of spring-loaded sliding pins or the other cylinder cover is mounted on a bifurcated member which is adapted to pivot about a horizontal axis against the action of a spring.

The pump according to the invention is preferably mounted on a horizontal base which is provided with lateral extensions for increasing the stability of the base. In order to render the pump more easily portable the space required by it may be reduced by making the base of two parts and by fitting one part in such a manner upon the other that the lateral extensions of the two parts will be directly adjacent to each other.

Furthermore, at least one cylinder cover is adapted to be disconnected from its support, for example, by means of a screw connection, in order to permit the bellows to be easily exchanged.

The above-mentioned and further objects, features and advantages of the present invention will become more clearly apparent from the following detailed description thereof, particularly when the same is read with reference to the accompanying drawings, in which—

FIGURE 1 shows a side view of an air pump according to the invention in the starting position;

FIGURE 2 shows a side view of the pump according to FIGURE 1 in a position in which the rear

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cylinder cover has been turned about its axis at an angle of approximately 90°;

FIGURE 3 shows a top view of the pump according to FIGURE 1;

5 FIGURE 4 shows a side view of a modification of the pump according to the invention;

FIGURE 5 shows a side view of the pump according to FIGURES 1 and 3 in the position for transport or storage; while

10 FIGURE 6 shows a diagrammatic illustration of a gear system for producing the reciprocating movements of the right cylinder cover.

Referring first to FIGURES 1 to 3 of the drawings, the pump according to the invention comprises a normally cylindrical bellows 1 which is removably clamped at both ends in cylinder covers 3 and 4 of sheet metal or plastic, for example, by means of a spring ring which is pressed into each cylinder cover and connected to the respective end of the bellows. Cover 3 is provided with an air inlet opening 5 and an inlet valve 6 which may in the simplest form consist of a rubber disk which is riveted only at one side to the cover. Cover 4 has an air outlet opening 7 containing a check valve 8 and a nipple 9 for attaching a flexible tube 10. Check valve 8 may also be of a design as simple as the suction valve 6 and may also consist of a rubber disk which is secured only on one side. In this case, cover 4 is preferably provided with an intermediate partition 45 to which the rubber disk which serves as a check valve 8 is secured at the side facing toward the outside of cover 4.

Cover 3 is provided with two diametrically opposite projecting pins 11 and 12 which engage into a pair of pins 13 and 14 on a crossbar 15 in which these pins 13 and 14 are removably secured by setscrews 16. Crossbar 15 is rigidly secured to a drive shaft 17 which may be turned back and forth by a motor 18 about an angle of approximately 100°. Motor 18 is for this purpose provided with an eccentric gear unit 19 which is diagrammatically illustrated in FIGURE 6. By means of several intermediate gears, the motor shaft 20 drives a gear 21 which has a pin 22 in an eccentric position thereon. A gear rack 23 which is slidable in a guide member 24 is rotatably mounted at one end on pin 22 and thus reciprocated thereby. Rack 23 engages with a pinion 25 on drive shaft 17 of the pump which is thus continuously turned back and forth.

Motor 18 and gear unit 19 thereon are mounted on drive shaft 17 which by means of a bearing 26 is mounted on a bearing bracket 27 on a base 28 which carries the pump.

For camping purposes, it is advisable to use a 6 or 12 volt motor which may be connected to the starter battery of an automobile by means of a cable 29. Motor 18 may also be provided with a switch 30 for easily starting and stopping the same.

As evident from the drawings, the pumping effect is produced by alternately lengthening and shortening the size of the chamber in bellows 1 by turning the end of the bellows which faces toward motor 18 by means of crossbar 15 back and forth about an angle of approximately 100° and by thus twisting the bellows. Since by this twisting movement, the length of the bellows is reduced, one of the two cylinder covers 3 or 4 of bellows 1 must be resiliently movable in the axial direction of the bellows. This is done according to the embodiment as shown in FIGURES 1 to 3 in such a manner that the cylinder cover 4 at the left side of the bellows is mounted by a pair of pins 31 within a bifurcated supporting member 32 which is pivotably mounted at 33 on base 28. A pair of tension springs 34 tend to maintain bellows 1 in the extended position in which it has a cylindrical shape and in which the

bifurcated supporting member 32 extends substantially perpendicular. In the operation of the pump bellows 1 will be shortened when being twisted due to the fact that the left cover 4 will yield in the axial direction of the bellows when the bifurcated member 32 pivots to the position as shown in FIGURE 2.

FIGURE 4 illustrates another embodiment of the invention according to which the cylinder cover 3 at the driving side of the pump is connected to crossbar 15 by means of pins 36 which are slidable therein against the action of springs 37. When in the operation of the pump crossbar 15 is turned to twist bellows 1, the latter will be shortened due to the fact that pins 36 on cover 3 will slide in crossbar 15 toward the left of FIGURE 4 against the action of springs 37.

Base 28 of the pump consists of two flat iron bars 38 and 39 of a substantially equal length which in the operative position according to FIGURE 1 are connected to each other by pins 40. For increasing the stability of the base, each bar 38 and 39 is provided with a crossbar 41 or 42, respectively. In the shipping position of the pump, as shown in FIGURE 5, the two longitudinal bars 38 and 39 are placed upon each other in a position in which the connecting pins 40 on bar 38 engage into bores 43 in bar 39 at both sides of bearing bracket 27, and in which the two crossbars 41 and 42 lie directly adjacent to each other. The length of the pump will thus be considerably reduced, permitting it to be stored and transported very easily and within a small space.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. An air pump comprising a substantially cylindrical bellows of flexible material, a pair of covers secured to each end of said bellows respectively, an air inlet valve in one of said covers, an air outlet valve in the other of said covers, a pump base, means for nonrotatably mounting one of said covers on said base, means for rotatably mounting the other cover on said base, eccentric gear means for rotating said other cover back and forth about its axis, so as to twist and untwist said bellows, a motor operably connected to said gear means for actuating said eccentric gear means, support means enabling one of said covers to move in an axial direction from a predetermined starting position toward the other cover during said twisting movement of said bellows and spring means engaging with said axially movable cover for returning it to the starting position during the untwisting movement of said bellows.

2. An air pump comprising a pump base, a bifurcated supporting member pivotably secured to said base, a fixed support member mounted on said base and spaced from said bifurcated member, a substantially cylindrical bellows of flexible material, a pair of covers secured to each end of said bellows respectively, one of said covers being pivotably mounted in said bifurcated member and having an air outlet valve and being axially displaceable from a predetermined starting position toward the other of said covers, a crossbar secured to said other cover, said other cover being provided with an inlet valve, a drive shaft secured to said crossbar, an electric motor provided with an eccentric gear unit mounted on said fixed support, said eccentric gear unit being connected to said drive shaft for repeatedly turning said drive shaft

back and forth about its axis so as to twist and untwist said bellows during the motor's operation and a spring having one end secured to said bifurcated member and another end to said base for biasing said axially displaceable cover to said starting position during the untwisting movement of said bellows.

3. An air pump comprising a pump base, a pair of spaced supporting members fixedly secured to said base, one of said members being bifurcated, a substantially cylindrical bellows of flexible material, a pair of covers secured to each end of said bellows respectively, one of said covers being mounted in said bifurcated member, the other of said covers being provided on its periphery with a pair of diametrically opposite projections, a crossbar disposed adjacent said other cover, a pair of pins slidably extending through the respective ends of said crossbar, one end of each of said pins engaging with said projections, a pair of coil springs mounted between the other ends of said pins and said crossbar for biasing said other cover adjacent said crossbar, said other cover being axially displaceable from a predetermined starting position toward said one cover, a drive shaft secured to said crossbar, an electric motor provided with an eccentric gear unit mounted on the other of said supporting members, said eccentric gear unit being connected to said drive shaft for repeatedly turning said drive shaft back and forth about its axis so as to twist and untwist said bellows during the motor's operation, said springs urging said other axially displaceable cover to said starting position during the untwisting movement of said bellows.

4. An air pump as defined in claim 1, in which said motor and said eccentric gear means are adapted to turn said rotatable cover back and forth about an angle of approximately 100°.

5. An air pump as defined in claim 4, further comprising an intermediate member, means for connecting said rotatable cover to said intermediate member so as to be nonrotatable but slidable in the axial direction of said bellows relative to each other, said spring means acting upon said rotatable cover and said intermediate member.

6. An air pump as defined in claim 5, further comprising an elongated base having crossbars, said pump being mounted on said base.

7. An air pump as defined in claim 6, in which each of said parts of said base comprises an elongated member and a cross-bar secured to one end thereof, said elongated members being superimposed upon each other, said crossbars being disposed within the same plane, said crossbars being spaced from each other in said extended position and closely adjacent to each other in said contracted position of said base.

8. An air pump as defined in claim 7, further comprising means for removably connecting at least one of said covers to its mounting means.

9. An air pump as defined in claim 6, in which said base comprises two parts, one of said parts being provided with a pair of upwardly extending pins, the other of said parts having at least two pairs of bores at its respective ends, each of said pair of bores being adapted to interchangeably receive said pins for connecting said parts to each other to set up said pump in an operative or nonoperative position.

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