March 8, 1966 G. O. SCHUR 3,238,714

THRUST MOTOR

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FIG. 1.

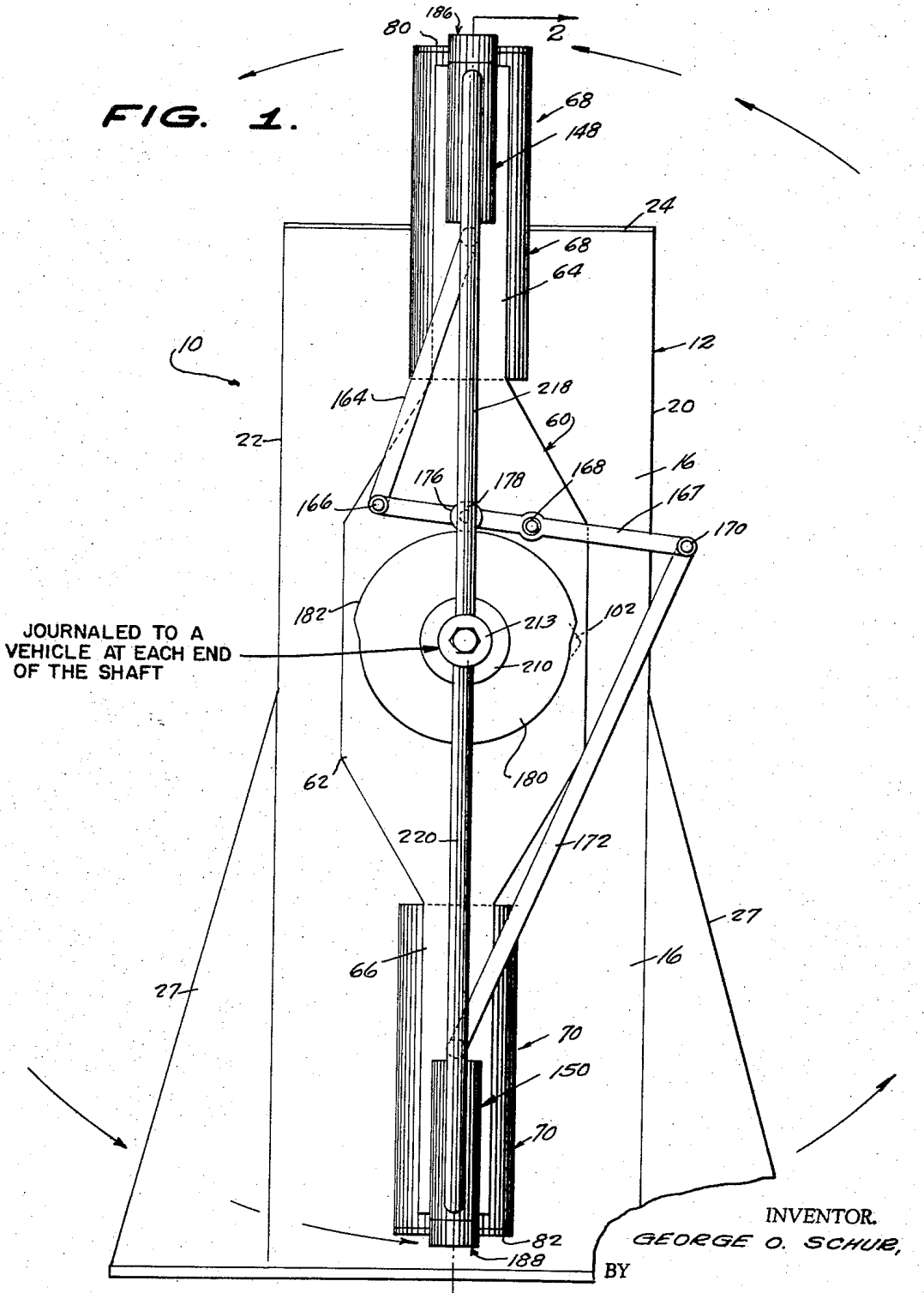

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FIG. 2.

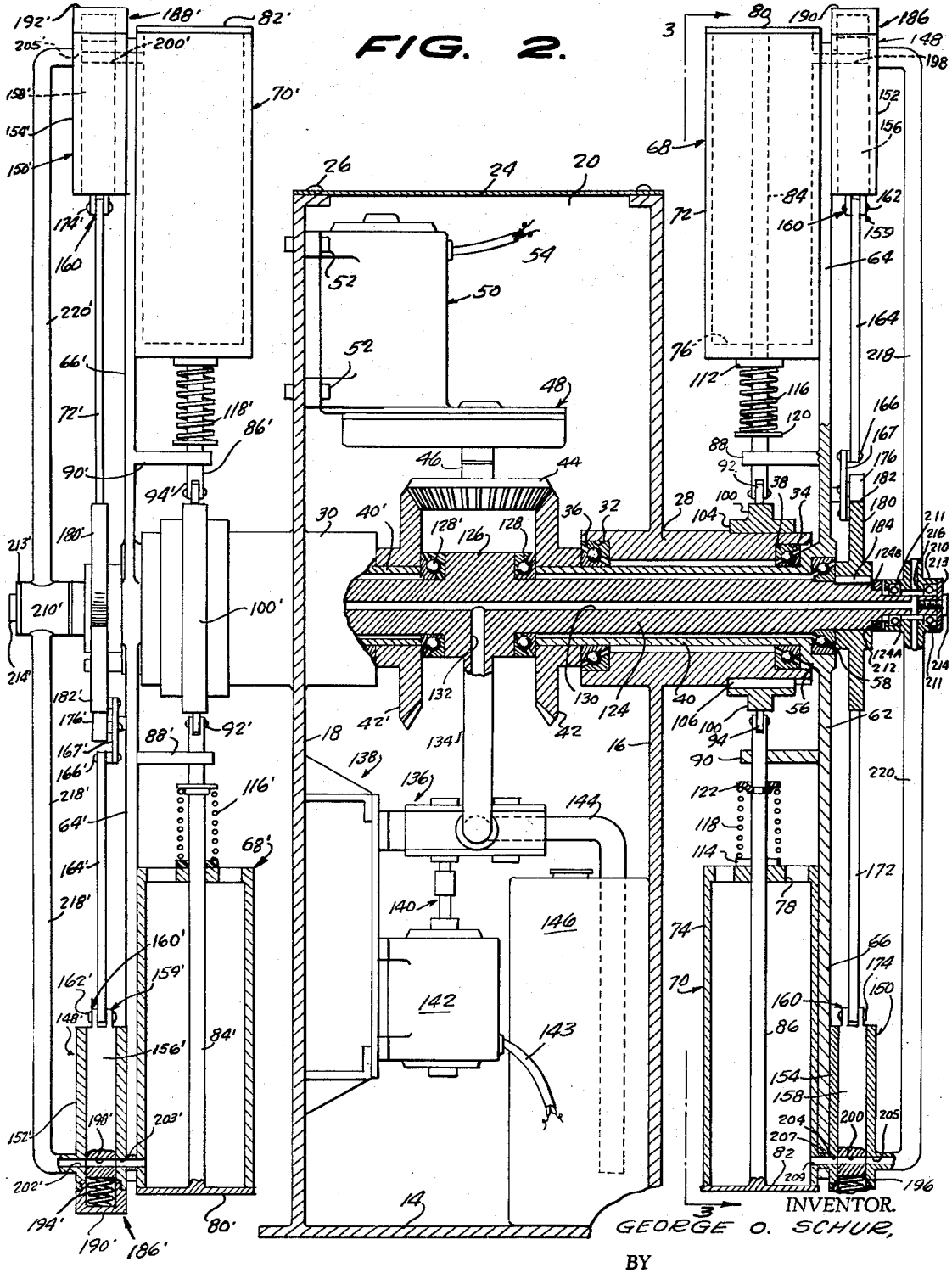

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FIG. 3.

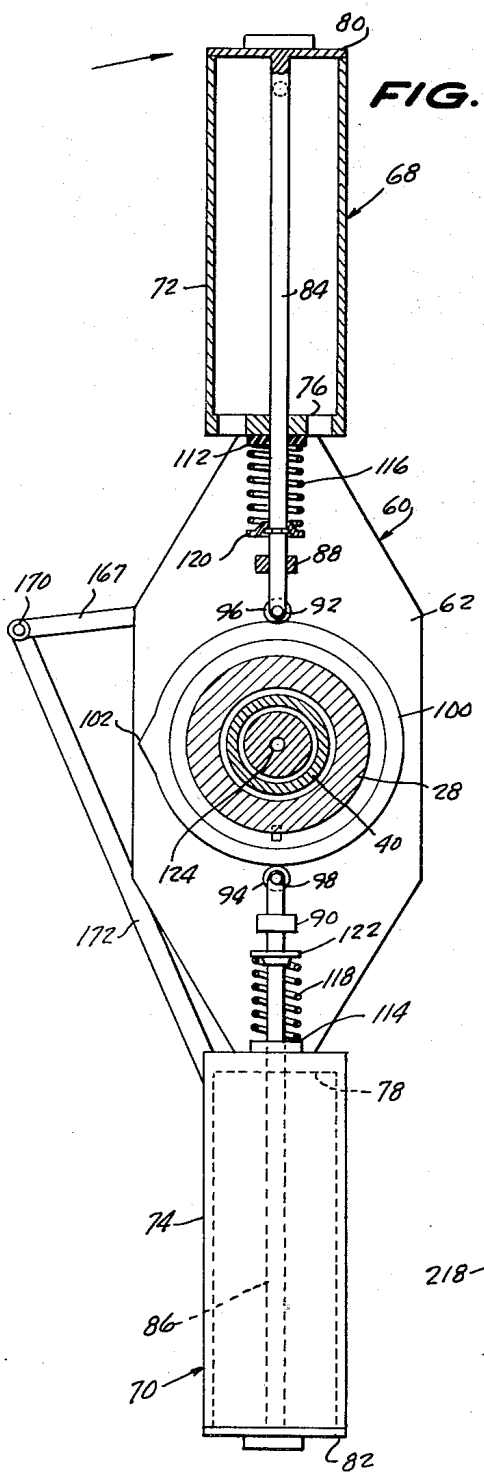


FIG. 4.

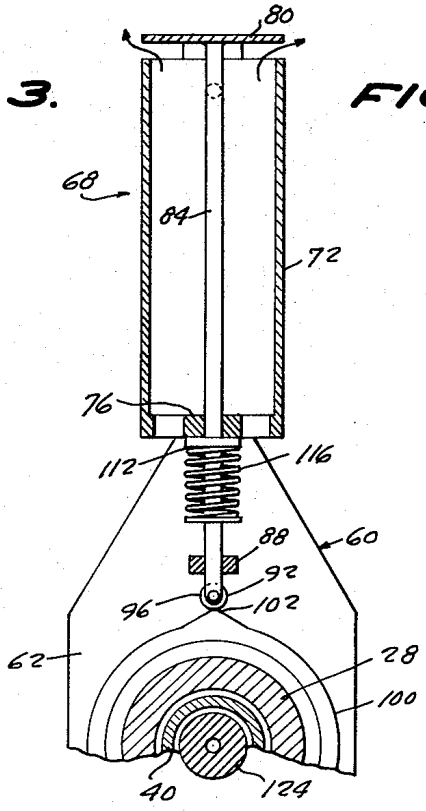
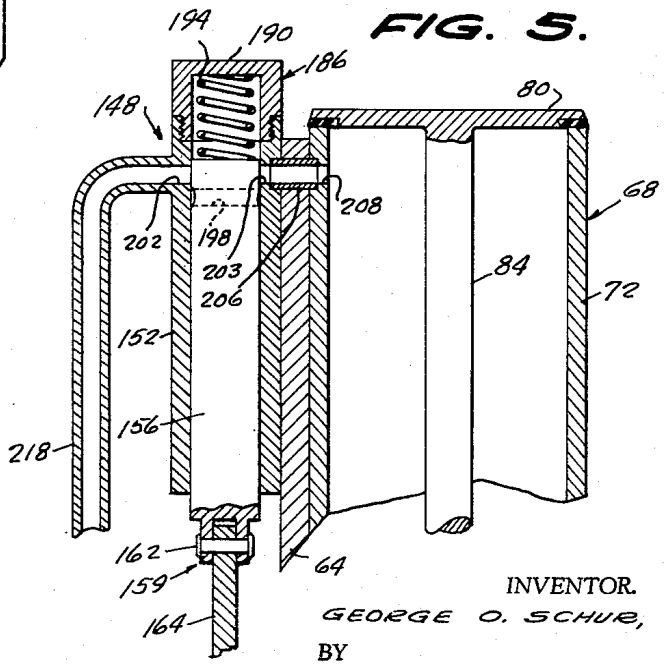


FIG. 5.



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THRUST MOTOR

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5 Claims. (Cl. 60—35.5)

This invention relates to the general field of propulsion devices and, more specifically, the instant invention pertains to thrust-type generating machines or devices. One of the primary objects of this invention is to provide propulsion means for a thrust-generating machine or device in conjunction with one or more rotating blades to increase the propulsive or thrust power thereof.

Another object of this invention is to provide a propulsion or thrust machine or device in association with a pair of contra-rotating blades mounted on a common shaft.

A further object of this invention is to provide a propulsion or thrust machine or device wherein the operating medium comprises a fluid or liquid.

This invention contemplates, as a still further object thereof, the provision of a propulsion or thrust machine or device which is non-complex in construction and assembly, inexpensive to manufacture, and which is durable in use.

Other and further objects and advantages of the instant invention will become more manifest from a consideration of the following specification when read in conjunction with the annexed drawings, in which:

FIGURE 1 is a front elevational view of a propulsion or thrust machine or device constructed in accordance with this invention;

FIGURE 2 is a longitudinal detail medial, cross-sectional view, FIGURE 2 being taken substantially on the vertical plane of line 2—2 of FIGURE 1, looking in the direction of the arrows;

FIGURE 3 is a detail cross-sectional view, partly in elevation, FIGURE 3 being taken substantially on the vertical plane of line 3—3 of FIGURE 2, looking in the direction of the arrows, FIGURE 3 illustrating the relative positions of certain component elements of the device when the fluid or liquid receptacle valves are in their closed positions;

FIGURE 4 is a fragmentary detail, cross-sectional view similar to FIGURE 3, but 90 degree out-of-phase therewith, FIGURE 4 illustrating the relative positions of certain component elements of the device when one of the receptacle valves has been moved to its open position; and

FIGURE 5 is an enlarged detail, cross-sectional view illustrating one of the piston-type valves controlling the loading of one receptacle when its valve is in its closed position.

Referring now more specifically to the drawings, reference numeral 10 designates a propulsion or thrust-type generating machine or device constructed in accordance with the teachings of this invention. The machine 10 is seen to comprise a vertically-elongated substantially-hollow rectangular housing 12 including a normally horizontal, substantially-rectangular base plate 14 from which arise integrally-formed, laterally-spaced and substantially-parallel rectangular front and rear walls 16, 18, and similar side walls 20, 22. A substantially-rectangular top wall 24 is releasably secured by screws 26 to the upper ends of the front, rear and side walls to permit inspection, assembly and repair of the mechanism, when required, the mechanism being described in detail below.

If desired, the housing 12 may be reinforced by gussets or ribs 27 integrally connected with the side walls 20, 22 and the base plate 14 (see FIGURE 1).

As is seen in FIGURE 2, the front and rear walls 16, 18 are integrally-formed with an enlarged hollow, cylindrical and coaxially-aligned bosses 28, 30, respectively,

each of which is identically constructed and provided with identical component elements. Thus, to avoid reiteration, only the construction of the elements carried by the boss 28 and associated therewith will be described in detail, and corresponding elements carried by or associated with the boss 30 have been assigned the same reference numerals to which has been adding a prime mark to effect differentiation. Thus, it is seen that the boss 28 is counterbored at 32, 34 at its opposed ends to receive angular contact ball bearings 36, 38, respectively, therein, and in which is journalled for rotation en elongated substantially hollow tubular, cylindrical sleeve 40.

As is seen in FIGURE 2, the boss 28 has an inner end portion which carries a bearing 36 that projects laterally from the front wall 16 into the housing 12. The sleeve 40 also has an inner end portion projecting into the housing 12 beyond the bearing 36 and has keyed thereto a bevel gear 42. The bevel gears 42, 42' are disposed in spaced confronting and parallel relation and are in mesh with a third bevel gear 44 carried on the output shaft 46 of a conventional speed reducer 48 driven by a conventional electric motor 50. The motor 50 is secured by the usual means 52 to the rear wall 18 and is energized through the customary electric cable 54 adapted for connection with a proper source of E.M.F., not shown.

From the differential just described, it will be readily ascertained that the shafts 40, 40' will rotate in contra-directions.

The other end of the boss 28 carrying the bearing 34 projects laterally from the front wall 16 and is exterior of the housing 12. As is seen in FIGURE 2, the outer end of the sleeve 40 terminates in a substantially hollow cylindrical hub 56 in which is disposed an annular contact ball bearing 58. The hub 56 is also integral with an elongated polygonal plate 60 symmetrical about its major and minor axes. The plate 60 also includes a main body portion 62 (see FIGURE 1) having integral elongated, substantially-rectangular arms 64, 66 projecting from a pair of oppositely-disposed sides thereof and extending in opposite directions on the major axis of the main body portion 62.

Fixedly secured to the outer ends of the arms 64, 66 are elongated, substantially-hollow cylindrical liquid-receiving receptacles 68, 70, respectively, with the longitudinal axis of the latter being parallel to the longitudinal axis of the former. It should be noted, at this point, that the receptacles 68', 70' are located substantially 180 degrees out-of-phase with respect to their respective counterparts, the receptacles 68, 70. The receptacles 68, 70 include, respectively, hollow cylindrical side walls 72, 74 which are, preferably, integral with substantially-open or spider-type end walls 76, 78 disposed in spaced, parallel and confronting relation. The other ends of the receptacles 68, 70 are normally closed by valves 80, 82, respectively, the valves 80, 82 being connected with operating mechanism to be described to cause the same to open and thereby vent the receptacles 68, 70 to the atmosphere.

The adjacent sides of the valves 80, 82 have fixedly secured thereto one of the ends of cylindrical valve-actuating shafts 84, 86, the other ends of the shafts 84, 86 projecting toward each other and extending for reciprocation through and beyond the end walls 76, 78. As is seen in FIGURES 2, 3 and 4, the shafts 84, 86 are also adapted to reciprocate through the outer ends of substantially-rectangular guide blocks 88, 90, the other ends of the latter being integral with the main body portion 62 of the plate 60 and which extend laterally therefrom.

The shafts 84, 86 are coaxially-aligned, and the four mentioned other ends thereof have cam follower rollers 92, 94 rotatably supported thereon by pins 96, 98, respectively. To serve a function to be described, the rollers

92, 94 track a cam 100 having a lobe 102. The hub 104 of the cam 100 is keyed at 106 to the outer end of the boss 28.

Attention is here directed to the fact that the lobe 102' of the cam 100' is disposed 180 degrees away from the location of the lobe 102 on the cam 100.

Surrounding the shafts 84, 86 and applied to the outer ends of the end walls 76, 78 are washers 112, 114. Also surrounding the shafts 84, 86, are, respectively, helicoidal springs 116, 118, the outer ends of the latter seating against the washers 112, 114. The other ends of the springs 116, 118 engage and are anchored in conventional spring seats 120, 122 fixedly secured to the shafts 84, 86 intermediate their respective ends for reciprocable movement therewith. The springs 116, 118 are under compression and consequently, the valves 80, 82 are constantly biased for movement toward their respective closed positions.

Extending axially through the sleeves 40, 40' is an elongated stationary shaft 124, the outer ends of the shaft 124 being journaled in bearings 58. The shaft 124 intermediate its ends is integrally-formed with an enlarged coaxial, cylindrical boss 126 which is located between the adjacent sides of the bevel gears 42, 42'. Interposed between the remotely-disposed sides of the boss 126 and the adjacent sides of the bevel gears 42, 42' are angular contact ball bearings 128, 128', to serve a function to be described. The shaft 124 is provided with an elongated axial bore 130 extending therethrough. The bore 130 connects through a passage 132 with one end of a conduit 134, the other end of the conduit 134 being connected with an outlet or pressure side of a liquid or fluid pump 136. The pump 136 is fixedly connected, by conventional means, to one end of a bracket 138 that is, in turn, fixedly secured to the wall 18. The pump 136 is driven through drive shaft means 140 driven by an electric motor 142 fixedly secured to the other end of the bracket 138, the motor 142 being energized through a cable 143. The inlet or suction side of the pump 136 is connected to one end of an elongated substantially-hollow conduit 144, the other end of the latter extending into a hollow refillable container 146 adapted to receive a liquid or fluid. It is understood, of course, that the motor 142, the pump 136 and the container 146 are all disposed within the housing 12.

Also fixedly secured to the remotely-disposed ends of the arms 64, 66 are piston-type valves 148, 150 including elongated substantially-hollow cylindrical casings 152, 154 having valve pistons 156, 158, respectively, mounted for reciprocation therein. The valves 148, 150 are coaxially-aligned, and the confronting ends of the valve pistons 156, 158 are formed with outwardly and longitudinally-extending pairs of lugs 159, 160, of which the pairs of lugs have pivotally connected thereto on pivot pin 162 (see FIGURES 2 and 5) one end of an elongated lever 164. The other end of the lever 164 is pivotally connected at 166 to one end of a second lever 167. The lever 167 is center-pivoted at 168 on the main body portion 62 of the plate 60, and its other end is pivotally connected at 170 to one end of a third lever 172. The other end of the last-mentioned lever is pivotally connected on pin 174 (see FIGURE 2) between the pair of lugs 160. The lever 167 between the pivot pins 166 and 168, has a cam follower roller 176 rotatably connected thereon by pin 178.

The cam follower roller 176 is adapted to trace a cam 180 having a high cam lobe 182 extending throughout substantially 180 degrees, the cam 180 being keyed at 184 to the outer end of the shaft 124 to prevent rotation thereof, and the cam follower roller 176' traces the cam 180' and its lobe 182', the lobe 182' being 180 degrees out-of-phase with respect to the other lobe 182.

Each of the valve casings 150, 152, at their respective remotely-disposed ends, is provided with a releasable cap 186, 188, each of the latter having end walls 190, 192 respectively. Interposed between the end walls 190, 192

and the adjacent ends of the valve pistons 156, 158 are helicoidal springs 194, 196, respectively, under compression. Thus the valve pistons 156, 158 are constantly biased for movement toward each other and away from their immediately-adjacent end walls 190, 192, by helicoidal springs 194, 196.

The construction of the valve pistons 156, 158 is identical, one with respect to the other, and the valve pistons 156, 158 are seen to be provided with transverse diametrically-extending passages 198, 200, respectively, adjacent their remotely-disposed ends (see FIGURE 5). The valve casings 152, 154, adjacent their respective outer ends, are formed with a pair of diametrically-opposed ports 202, 203 and 204, 205, respectively, and the ports 203, 204 are countersunk to receive therein one of the ends of a pair of cylindrical conduits 206, 207, respectively. The other ends of the conduits 206, 207 extend through the arms 64, 66, respectively, and connect with countersunk ports 208, 209 formed in the side walls of the receptacles 68, 70, respectively. The valve pistons 156, 158 are adapted for reasons to be described below, to reciprocate in order to move the passages 198, 200 into and out of alignment with the ports 202, 203, and 204, 205, respectively.

Referring again to FIGURE 2, it is seen that the extreme outer end of the shaft 124 is reduced in diameter at 124A forming a shoulder 124B. It will be understood that a similar construction is made at the opposed end of the shaft 124, but is not shown in the drawings. An elongated substantially-hollow cylindrical connector 210 is mounted on the reduced end 124A and is journalled at 211 for rotation therearound. Interposed between the inner end of the connector 210 and the shoulder 124B is a sealing and thrust collar 212. A cover plate 213 extends across the outer end of the connector 210 and is secured thereacross by an axially-extending screw 214 threaded into the outer end of the reduced portion 124A, the cover plate 213 and the screw 214 coacting to hold the connector against endwise displacement.

The connector 210 is diametrically bored as at 216 and is integrally connected with one of the ends of a pair of conduits 218, 220 which project radially therefrom. The other ends of the conduits 218, 220 connect with the ports 202, 205 formed in the casings 152, 154. As is clearly seen in FIGURE 2, the bore 130 is in open communication with the bore 216.

From the foregoing description it now becomes manifest that when the motor 142 is energized the pump 136 will be driven drawing liquid within the container 146 through the conduit 144 for discharge through the conduit 134 into the passage 132. From the passage 132 the liquid or fluid passes in opposite directions through the bore 130 to reach the diametrically-extending bore 216. From the bore 216 the fluid or liquid passes through the conduits 218, 220 and, assuming that the passages 198, 200 of the valve pistons 156, 158 are aligned with the passages 202, 203, and 204, 205, fluid will enter into the receptacles 68, 70. In the event there is non-alignment between these passages and ports, no fluid or liquid will be admitted to the receptacles.

Having described the component elements of this invention in detail, the operation of the propulsion or thrust-developing machine or device is as follows:

To operate the device or machine 10, and assuming the component elements of the machine are in their respective positions as shown in FIGURES 1, 2 and 3, the operator now energizes the motor 50 in order to drive the differential gears 42, 42' and 44 thereby driving the shafts 40, 40' in contradirections, causing the arms 64, 66 and 64', 66', respectively, to rotate in the direction of their respective associated shafts. When the arms 64, 66 and 64', 66' have reached a desired predetermined speed, the motor 142 is energized to operate the pump 136, whereby a liquid, preferably water, in the container 146 is pumped through the conduit 134 and through the passage 132 into the bore 130. From the bore 130 the liquid passes to the connec-

tors 210, 210' and discharges through the bore 216 into the conduits 218, 220, 218', 220'.

Depending on the positions of the valve pistons 156, 158 and 156', 158', the liquid will be admitted to or cut off from the receptacles 68, 70 and 68', 70'. In the several figures referred to above, the cam follower rollers 176, 176' are shown as being at the mid-points of the respective associated cam lobes 182, 182' of the cams 180, 180'. Under these conditions, the receptacles 68, 70 and 68', 70' are filling, for the valves 148, 150 and 148', 150' have been moved to their open positions. The cams 92, 94 and 92', 94' are tracing, at this time, the low sides of their respective cams 100, 100'.

As the arms 64, 66 and 64', 66' continue to turn in their respective directions for substantially 90-degrees from their illustrated positions in the above-referred to figures, the cam follower rollers 176, 176' descend the trailing edges of their associated cam lobes 182, 182', thereby closing the valves 148, 150 and 148', 150' to cut off the flow of liquid to the receptacles 68, 70 and 68', 70'. At substantially the same time, the cam follower rollers 94, 92' begin the engage and trace upwardly the cam lobes 102, 102' of the cams 100, 100' forcing open, momentarily, the valves 82, 80', whereby the liquid in the receptacles 70, 68' is discharged by centrifugal force to the atmosphere, the valves 82, 80' being forced open against the bias of the springs 118, 116'. Now, as the cam follower rollers 94, 92' descend their respective cam lobes 102, 102', the valves 82, 80' return to their respective closed positions under the influence of the springs 118, 116'.

The arms 64, 66 and 64', 66' now continue their contra-rotation for the next 180-degrees in an unbalanced condition, that is, the receptacles 70, 68' are empty and the receptacles 68, 70' are full of the liquid. The cam follower rollers 92, 94' now engage and ride up the cam lobes 102, 102' to open the valves 80, 82' against the bias of the springs 116, 118', whereby the liquid therein is discharged to the atmosphere by centrifugal force. As the rollers 92, 94' descend the lobes 102, 102', the rollers 176, 176' engage the leading ends of the cam lobes 182, 182' causing the valves 148, 150 and 148', 150' to re-open to supply liquid, substantially simultaneously, to the receptacles 68, 70 and 68', 70'. The receptacles 68, 70 and 68', 70' will continue to fill for substantially the next 180-degrees of rotation of the arms 64, 66 and 64', 66' until the cam follower rollers 176, 176' ride off the trailing ends of the cam lobes 182. This closes the valves 148, 150 and 148', 150' and the filled receptacles 68, 70 and 68', 70'. At substantially the same time the cam follower rollers 94, 92' engage and trace upwardly the cam lobes 102, 102' of the cams 100, 100' momentarily forcing open the valves 82, 82' so that the liquid in the receptacles 70, 68' is discharged by centrifugal force to the atmosphere. Under these circumstances the valves 82, 80' are forced open against the bias of the springs 118, 116'. As the cam follower rollers 94, 92' descend their respective cam lobes 102, 102, the valves 82, 80, return to their respective closed positions under the influence of the springs 118, 116'.

As has been stated above, the receptacles 68, 70 and 68', 70' are provided with open end walls of the spider-type, as designated at 76, 78. This type of construction is utilized to pass air freely from the inner ends of the receptacles 68, 70 and 68', 70', whereby entrapment thereof is prevented. The liquid medium will not pass through the open end walls 76, 78 since centrifugal force holds the liquid in the outer end portions of the receptacles 68, 70 and 68', 70', this force being borne by the valves 80, 82' when these valves are in their closed positions.

Having described and illustrated one embodiment of this invention in detail, it will be understood that the same is offered by way of example only, and that this invention is to be limited only by the scope of the appended claims.

What is claimed is:

1. A propulsion or thrust-developing machine or device comprising a a base, a plate, first means mounting said plate for rotation on said base, motor means to effect rotation of said first means, a pair of opposed liquid-receiving receptacles fixedly secured to said plate, first valve means for each of said receptacles operable to vent the remote ends of said receptacles to the atmosphere, the adjacent ends of said receptacles being constantly vented to the atmosphere, liquid-supply means mounted on said base for supplying said receptacles with liquid, means connecting said liquid-supply means with said receptacles at points between their adjacent and remote ends, second valve means connected with said last-named means to control the supply of liquid to said receptacles, and control means for each of said second valve means, said control means being operable to close said first valve means while opening said second valve means and to close said second valve means while sequentially opening and closing said first valve means.

2. A propulsion or thrust-developing machine or device comprising a base, a plate mounted for rotation on said base, a pair of arms extending, respectively, on opposed sides of said plate, a receptacle mounted on the remotely-disposed ends of each of said arms, a first valve extending across each of the remotely-disposed ends of said receptacles, the adjacent ends of said receptacles being constantly vented to the atmosphere, said first valves being movable toward and away from said receptacles to vent the same to the atmosphere, a liquid container mounted on said base, a second valve for each of said receptacles, each of said second valves being fixedly secured to said arms for rotation therewith, means connecting the outlet side of each of said second valves with the interior of said receptacles at points between their adjacent and remote ends, respectively, means connecting said liquid container with the inlet ports of each of said second valves, respectively, and timing means to effect sequential opening and closing of said first valve means while said second valve means is closed, and to substantially simultaneously open said second valve means when said first valve means is closed.

3. A propulsion or thrust-developing machine or device comprising a base having a side wall projecting from a side thereof, a shaft extending transversely through said wall and projecting on opposite sides thereof, said shaft having an axially-extending bore, a liquid container on said base, pump means connecting liquid in said container with said bore, a plate mounted on one end of said shaft for rotation relative thereto, arms projecting radially away from a pair of opposed ends of said plate, a receptacle mounted on each remotely-disposed end of said arms, a first valve to atmosphere at the remotely-disposed end of each of said receptacles, the adjacent ends of said receptacles being vented to the atmosphere, a second valve connected on each of said arms, means connecting the outlet ports of said second valves with the interior of said receptacles at points between their adjacent and remote ends, conduit means connecting the inlet ports of said second valves with said bore, timing means alternately opening and closing the first valves, and to simultaneously open and close said second valves, said timing means being effective to open and close sequentially said first valves, said timing means being effective to close said second valves when either one of said first valves is open and to simultaneously open said second valves when both of said first valves are closed, and motor means on said base connected with said arms to effect rotation thereof.

4. A propulsion or thrust-developing machine or device comprising a base having a pair of side walls projecting laterally therefrom in the same direction and in spaced relation relative to each other, a shaft having its opposed ends supported on said walls, a bore extending transversely through said shaft, a pair of arms rotatably supported on said shaft on the opposite ends thereof, re-

spectively, motor means on said base to effect rotation of said arms, a receptacle fixedly secured to each of said arms at the remotely-disposed ends thereof and including first valve means for venting the remote ends of said receptacles to the atmosphere, the adjacent ends of said receptacles being vented to the atmosphere, a second valve for each of said receptacles, said second valves being fixedly secured to the remotely-disposed ends of said arms and juxtaposed with respect to the immediately-adjacent receptacle, means connecting the outlet port of said second valves with the interior of said receptacles at points between their adjacent and remote ends, conduit means connecting the inlet ports of said second valves with a source of fluid under pressure, and timing means alternately opening and closing said first valves and to simultaneously open and close said second valves, said timing means being effective to open, simultaneously, one of said first valves on one arm of each pair of arms, respectively, and to close said second valves simultaneously therewith, said timing means being effective to open said

second valves means when said first valve means are closed.

5. A propulsion or thrust-developing machine or device as defined in claim 4, wherein means are provided to counter-rotate said arms on the opposed ends of said shaft.

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