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W. J. CLEMENTS ET AL

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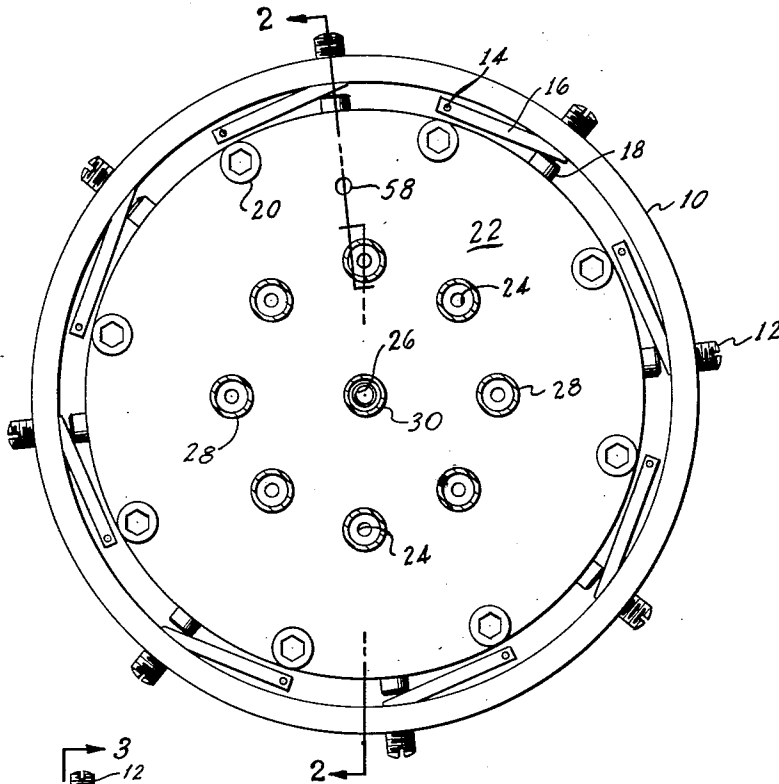


Fig-1

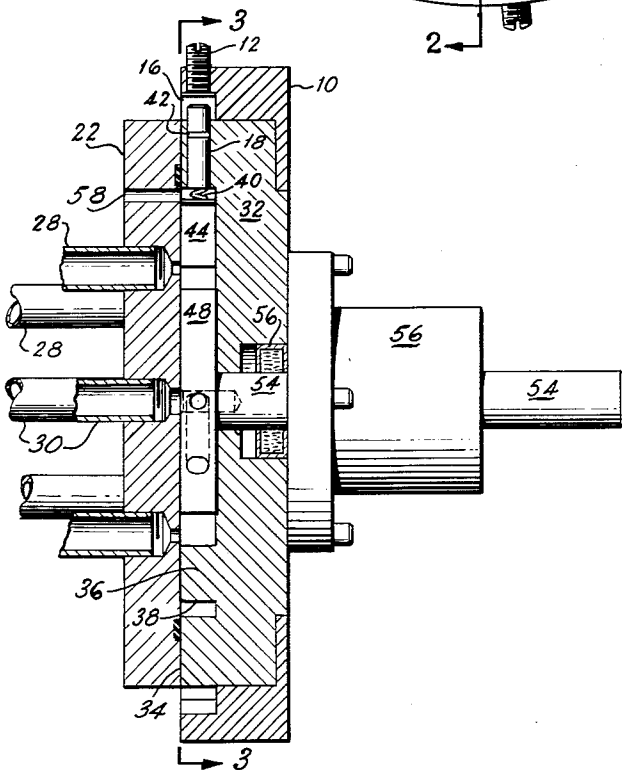


Fig-2

INVENTOR.
WALTER J. CLEMENTS
EMRICK ROCKE
BY
Eckhoff & Click
ATTORNEYS

May 22, 1962

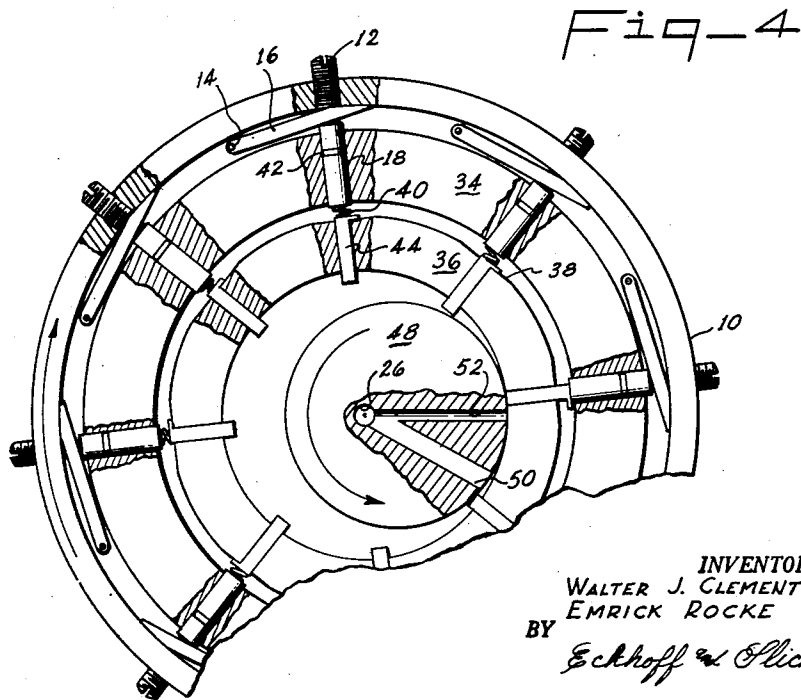
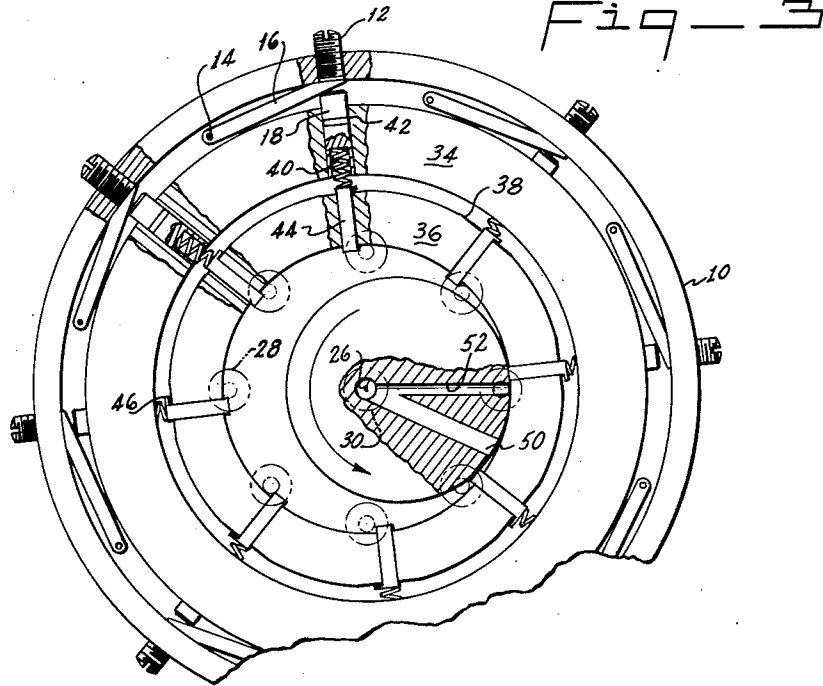
W. J. CLEMENTS ETAL

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3 Sheets-Sheet 2



INVENTOR.
WALTER J. CLEMENTS
EMRICK ROCKE
BY
Eckhoff & Flick
ATTORNEYS

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W. J. CLEMENTS ET AL

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3 Sheets-Sheet 3

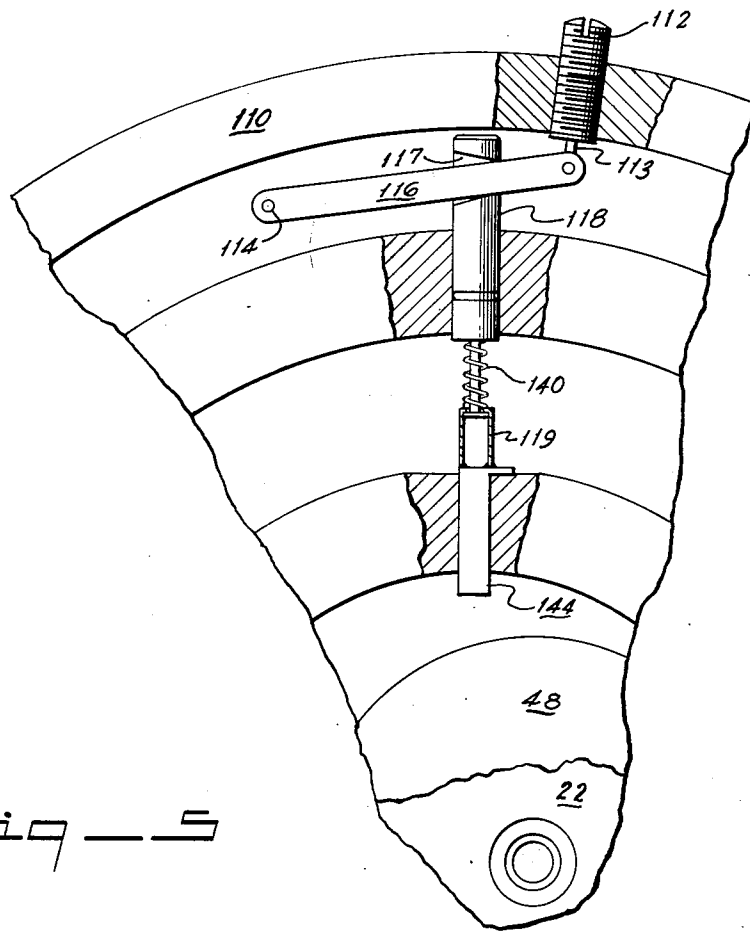


Fig - 5

INVENTOR.
WALTER J. CLEMENTS
EMRICK ROCKE
BY *Eckhoff and Click*

ATTORNEYS

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3,035,525
PUMPWalter J. Clements, 1506 Pine Knoll Drive, Belmont,
Calif., and Emrick Rocke, 4438 Edwards Lane, Castro
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This invention relates in general to a pump having a rotary impeller.

It is an object of this invention to provide a pump having a rotary impeller which may be operated in one manner to distribute quantities of liquid to various receptacles or in another manner to mix streams of liquids from a plurality of sources to form a single exit stream.

It is a further object of this invention to provide a device which is capable of pumping fluids in predetermined proportions to two or more receptacles or combustion chambers and which provides means for automatically varying the quantity of fluid pumped while maintaining the proportions in the predetermined ratios.

Still another object of this invention is to provide a pump having utility as a fuel injector which also serves as a fluid distributor and a timer so as to provide means for supplying fuel to individual cylinders of an internal combustion engine as required by the firing order.

It is still another object of this invention to provide a device which may be used as a fuel injector and which, when so used, meters predetermined quantities of fuel to individual combustion chambers in a proper timed sequence so as to make possible identical power impulses in cylinders spaced various distances from the injector.

Ancillary objects and advantages of this invention, if not specifically set forth, will become apparent during the course of the description which follows.

In the drawings:

FIGURE 1 is a plan view of one form of the assembled device of this invention;

FIGURE 2 is a side elevation partially in section taken through 2—2 of FIGURE 1;

FIGURE 3 is a plan view partially in section of a preferred embodiment of this invention with the top plate shown in FIGURE 1 removed to expose the interior;

FIGURE 4 is a fragmentary plan view partially in section showing the structure of FIGURE 3 with a slightly different throttle setting;

FIGURE 5 is a plan view similar to FIGURE 4 of an alternative form of the invention.

Broadly, this invention comprises an apparatus for directing the flow of fluids which may be used either as a proportioning pump for mixing a plurality of fluids in predetermined ratios or to direct a plurality of fluid streams to receptacles or combustion chambers in carefully measured and timed quantities. The invention comprises a cylindrical chamber having planar end walls, a plurality of passages through a wall of the chamber allowing passage of fluid streams therethrough, a plurality of vanes mounted for sliding movement into and out of the chamber, each vane being mounted adjacent one of the passages in the cylindrical chamber wall perpendicular to the cylindrical surface thereof, that portion of each vane extending into the chamber being of sufficient width to bridge the distance between the end walls of the cylindrical chamber whereby to form a seal with the rotary impeller to be discussed below. Resilient means are positioned to urge each of the vanes into the chamber and an impeller is mounted for rotation within the cylindrical chamber. The impeller has at least a single fluid passage extending entirely therethrough from a point slightly to one side of the high point. The passage extends laterally through the impeller to the axis thereof, and thereafter

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describes a right angle to form a coaxial passage extending entirely through one side of the impeller. Means for connecting exterior fluid conduits to each previously described passage through the wall and means for securing a fluid conduit to the coaxial end of the impeller passage are provided in the completed structure.

Referring now to the drawings wherein like characters refer to like parts throughout, there is seen in FIGURE 1 the complete structure having a cylindrical throttle ring 10 with a series of set screws 12. Pivotaly secured thereto by pins 14 are small planar elements 16. One end of each of these is free to swing, but is normally held in place by the interior cylindrical surface of the throttle ring 10 (or set screw 12) and pin 18. Screws 20 serve to secure front plate 22 having a series of radial ports 24 spaced equidistantly from one another and a single central port 26 to which are secured fluid conduits 28 and 30 respectively. As seen in FIGURE 2, the plate 22 obscures the front of the housing 32 having a pair of upstanding concentric circular flanges 34 and 36 which are separated by circular slot 38.

Pin 18 is slideably mounted in flange 34 and bears upon spring 40. A neoprene O-ring 42 provides a seal between the internal walls of the hole drilled through flange 34 and the pin 18. Each of the springs 40 is of the same length and resiliency, for reasons which will become apparent. Also mounted for sliding movement are vanes 44 which, as seen in FIGURE 2, are customarily placed under such pressure that they extend somewhat into the cylindrical chamber formed by the cylindrical inner surface of flange 36, the planar wall of housing 32 and the inner planar surface of plate 22. Each vane 44 has a small flange 46 provided for purposes of establishing a maximum degree to which the vane may slide into the aforementioned cylindrical chamber. A rotary impeller 48 is positioned within the chamber and is of a depth sufficient to bridge the entire distance between the planar surfaces of housing 32 and plate 22. The rotary impeller is provided with one passage 50 extending toward the axis from a point slightly on one side of the high point. On reaching the axis, the passage describes a right angle to become a coaxial passage extending out the top of the impeller to a point directly beneath port 26 of plate 22. A second auxiliary passage 52 extends inwardly from the impeller high point to the axis and joins the coaxial passage. The impeller shaft 54 passes through a liquid seal 56 mounted in the housing 32 and is journaled in bearing 56 (not shown in section).

The device may be used either as a pump for mixing quantities of various materials, such as paint, and ejecting a single stream or as a means of distributing fluids to various receptacles or combustion chambers. A preferred use of the structure is as a fuel injector. When used as a fuel injector, the rotary impeller 48 turns in the direction indicated in FIGURE 3, while the fuel is supplied through line 30 and passes through passage 50 to be sprayed in comet-like fashion in the volume formed immediately behind the turning impeller. Passage 50 is placed to minimize cavitation. Smaller passage 52 supplies fluid for purposes of assuring a tight seal between the cylindrical surface and the impeller high spot. Means may be provided, not shown, for connecting throttle ring 10 to a manually-operated throttle through a differential diaphragm and slip linkage in accordance with conventional practice. The injector may also be used on an engine operating at a constant speed in which case the aforementioned differential diaphragm structure would be eliminated and the setting of the throttle ring 10 controlled directly so as to set the r.p.m. of the engine.

As will be seen in FIGURE 3, rotation of the throttle ring 10 in a clockwise direction relative to housing 32

causes each of the planar elements 16 to depress its corresponding pin 18, in turn forcing the vanes 44 deeper into the chamber. This means that as the high point of the impeller strikes a vane, the chamber formed will be of greater size than previously and the quantity of fluid trapped and ejected will be increased. Conversely, rotating the throttle ring counterclockwise will allow the individual vanes to be withdrawn from the chamber; there is a tendency for them to remain withdrawn to a maximum extent due to the pressure of fluid within the chamber. This will decrease the size of the individual chambers formed as the impeller contacts a vane, thus to decrease the quantity of fluid ejected from the pump. When so used as a pump, the set screws 12 are necessary to compensate for variations in the length and resiliency of springs 40.

When the impeller is driven in a direction opposite from that indicated in FIGURES 3 and 4, the device acts as a proportioning pump, drawing fluids through each of conduits 28, mixing them in the cylindrical chamber formed by the inner surface of flange 36 and the front and rear walls aforementioned and ejecting the mixed fluid through conduit 30. This provides a structure capable of mixing fluids such as paint in various proportions. As will be seen, adjustment of the set screws 12 provides means for intaking greater or lesser quantities of any given fluid from each source, thus enabling the adjustment of fluid ratios over a wide range.

Also, it is self-evident that individual vanes 44 may be retracted entirely and the corresponding line(s) 28 plugged, if necessary, so as to decrease the number of individual fluid impulses (when the structure is used as an injector for multiple receptacles) or so as to allow for the mixing of fewer than eight different fluids.

Structures having a chamber $\frac{1}{4}$ " deep and a diameter of about $2\frac{1}{2}$ ", and a two inch diameter rotor with the axis thereof approximately one inch from the nearest edge, are about minimum in size for use with an eight cylinder internal combustion engine. Where it is desired to provide more than eight separate fluid impulses, a convenient method is to provide a separate and identical structure backed up against that described heretofore, with the rotor offset 180° and mounted on the same shaft. This counterweights the rotor elements and assures smoother operation. Of course, a chamber of greater capacity with more than eight radial ports is possible also.

Another alternative structure providing positive control over the pins 18, or equivalent, is that shown in FIGURE 5. Here, the set screws 112 are rotatably secured to pins 113 which, in turn, are pivotally secured to planar elements 116. Elements 116 ride in the grooves 117 at the sides of pins 118. Spring 140 serves to urge flanged tubular member 119 downwardly, the tubular member in turn supporting the vane 144.

As the control ring 110 is rotated counterclockwise, the planar elements 116 will slide in grooves 117 and pins 118 will be lifted whereby to withdraw the vanes from the fuel chamber. Conversely, when the control ring is turned in a clockwise direction, pins 118 will be lowered so as to force the vanes 144 into the chamber.

As aforementioned, when the device is used as a fuel injector, it is ordinarily desired to pump equal quantities through each of the individual exit ports with each turn of the rotor. However, it might be desired to fill containers of different capacities—quarts, pints, etc.—and in this event, appropriate settings would be made of screws 12. The same adjustments are necessary where quantities of different fluids are to be mixed and ejected through the single port 30.

For satisfactory operation, it is necessary to provide a pressure vent 58 having access to the space formed by notch 38 so as to provide means for exhausting any fluid which might leak between vanes 44 and the housing 32. Also, if various materials were being mixed, solid partitions spaced along the entire length of notch 38 might be

needed to prevent mixing therein of any chemicals leaking into that area and such an arrangement would require a series of pressure vents. In the absence of such a vent or vents, fluid pressure in the area defined by notch 38 would rise to a level sufficient to prevent the individual vanes 44 from retracting to the maximum extent permitted by springs 40. The pressure in area 38 must always be less than the pressure in the chamber in which the rotor 48 is turning, and this can be achieved only by providing a greater pressure in the feed line or lines than in the area 38.

When using the device as a fuel injector, release valves would be positioned in each of lines 28 which would be pre-set for the desired pressure, say 300 pounds, and the pump would be allowed to build up this pressure. When 300 pounds was reached the release valve would pop open and the given amount of fuel would be ejected, the valve closing immediately with the subsequent pressure drop.

As indicated, the major fluid passage 50 through the rotor terminates at a point just short of the high side of the rotor while the smaller passage 52 terminates exactly at the high point and less than 45° (preferably about 30°) from the larger passage. Placement of the large inlet passage 50 nearer the lower side of the rotor would result in air being trapped in the small sharply angular volume formed behind the impeller.

Elements 16 have been pictured as flat planar elements, but they might be also curved or contoured so as to provide varying ratios of fuel to air (where the device is used as a fuel injector). Finally, it would be possible to construct a device having only a single vane, in which event the inlet (or outlet, depending upon the direction of rotation of the impeller) need not pass through the shaft of the impeller but might simply be positioned in face plate 22 at a point well spaced from the single vane or might otherwise suitably enter the chamber. Certain advantages of the invention will still be gained since the vane is mounted in the chamber wall rather than in the impeller, as is conventional.

Obviously, many modifications and variations of this invention may be made without departing from the spirit and scope thereof, and therefore only such modifications should be imposed as are indicated in the appended claims.

We claim:

1. Apparatus for pumping fluids comprising: a cylindrical chamber having planar end walls; a plurality of passages through a wall of said chamber allowing for passage of fluids therethrough; a plurality of vanes mounted for radial movement into and out of said chamber along the curved surface thereof, each vane being mounted adjacent one of said passages in said cylindrical chamber wall, that portion of each vane extending into said chamber being of sufficient width to bridge the distance between the end walls of said cylindrical chamber; resilient means positioned to urge said vanes into said chamber; means for adjusting the radial position of said resilient means to cause said individual vanes to be urged greater or lesser distances into said chamber; an impeller mounted for rotation within said cylindrical chamber, said impeller having a high point thereon extending to the curved surface of said chamber at one point thereon, whereby to form a seal, said impeller extending the entire distance between said chamber end walls, said impeller having a fluid passage extending therethrough from a point along the edge thereof through the axis thereof; and means for securing exterior fluid conduits to each of said wall passages and said impeller passage at the axis thereof.

2. Apparatus for pumping fluids comprising: a cylindrical chamber having planar end walls; a plurality of passages through a wall of said chamber allowing for passage of fluids therethrough; a plurality of vanes mounted for radial movement into and out of said chamber along the curved surface thereof, each vane being mounted adjacent a passage in said cylindrical chamber wall, that portion of

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each vane extending into said chamber being of sufficient width to bridge the distance between end walls of said cylindrical chamber; resilient means mounted outside of said chamber and positioned to urge said vanes into said chamber; means for adjusting the radial position of said resilient means to cause said individual vanes to be urged greater or lesser distances into said chamber, said means comprising a throttle ring having means as a part thereof for depressing and allowing the retraction of each of said resilient means simultaneously as said throttle ring is rotated; an impeller mounted for rotation within said cylindrical chamber, said impeller having a high point thereon extending to the curved surface of said chamber at one point thereon, whereby to form a seal, said impeller extending the entire distance between said chamber end walls, said impeller having a fluid passage extending therethrough from a point along the edge thereof through the axis thereof; and means for securing exterior fluid conduits to each of said wall passages and said impeller passage at the axis thereof.

3. The structure of claim 2 wherein said impeller has a second fluid passage extending from the axis thereof to the high point thereof.

4. Apparatus for pumping fluids comprising: a cylindrical chamber having planar end walls; a plurality of passages through a wall of said chamber allowing for passage of fluids therethrough; a plurality of vanes mounted for radial movement into and out of said chamber along the curved surface thereof, each vane being mounted adjacent a passage in said cylindrical chamber wall, that portion of each vane extending into said chamber being of sufficient width to bridge the distance between the end walls of said cylindrical chamber; resilient means mounted outside of said chamber and positioned to urge said vanes into said chamber, said resilient means comprising springs resting against and supported by the outwardly extending ends of said vanes, each of said springs having resting on the opposite ends thereof a pin, said pin being mounted in a support therefor and being capable of movement toward and away from the corresponding spring; and an exterior throttle ring rotatably mounted about said pins, said throttle ring having surfaces as a part thereof so positioned that when said throttle ring is turned in one direction, said surfaces increasingly bear upon the said pins whereby to depress said pins and whereby rotation of said throttle ring in the opposite direction releases said pins and allows said pins to be retracted; an impeller mounted for rotation within said cylindrical chamber, said impeller having a high point thereon extending to the curved surface of said chamber at one point thereon, whereby to form a seal, said impeller extending the entire distance between said chamber end walls, said impeller having a fluid passage extending therethrough from a point along the edge thereof through the axis thereof; and means for securing exterior fluid conduits to each of said wall passages and said impeller passage at the axis thereof.

5. The structure of claim 4 wherein a plurality of set screws extend through said throttle ring and wherein said inclined surfaces of said throttle ring comprise a series of inclined planar members, the said inclined planar members consisting of elements pivoted at one end thereof to said throttle ring, said elements each having a single free end, the said free ends being positioned directly beneath the said set screws whereby said set screws may depress the free end of each of said pivoted elements.

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6. Apparatus for pumping fluids comprising: a cylindrical chamber having planar end walls; eight passages extending through a wall of said chamber allowing for passage of fluids therethrough; a plurality of vanes mounted for radial movement into and out of said chamber, each of said vanes being mounted adjacent one of said passages in said cylindrical chamber wall perpendicular to the cylindrical surface thereof, that portion of each vane extending into said chamber being of sufficient width to bridge the distance between the end walls of said cylindrical chamber; springs mounted outside of said chamber and positioned to urge said vanes into said chamber, said springs resting against and being supported by the outwardly extending ends of said vanes, each of said springs having resting on the opposite end thereof a pin mounted for radial sliding movement toward and away from said pins; a throttle ring surrounding said pins and having means as a part thereof for contact with said pins, said means being such as to depress said pins when said throttle ring is turned in one direction and to allow for the retraction of said pins when said throttle ring is moved in the opposite direction; an impeller mounted for rotation within said cylindrical chamber, said impeller having a high point thereon extending to the curved surface of said chamber at one point thereon, whereby to form a seal, said impeller extending the entire distance between said chamber end walls, said impeller having a fluid passage extending therethrough from a point along the edge thereof through the axis thereof; and means for securing exterior fluid conduits to each of said wall passages and said impeller passage at the axis thereof.

7. Apparatus for pumping fluids comprising: a cylindrical chamber having planar end walls; at least a single passage through a wall of said chamber allowing for passage of fluids therethrough; at least a single vane mounted for radial movement into and out of said chamber along the curved surface thereof, said vane being mounted adjacent said passage in said cylindrical chamber wall, that portion of said vane extending into said chamber being of sufficient width to bridge the distance between the end walls of said cylindrical chamber; resilient means positioned to urge said vane into said chamber; means for adjusting the radial position of said resilient means to cause said individual vanes to be urged greater or lesser distances into said chamber; an impeller mounted for rotation within said cylindrical chamber, said impeller having a high point thereon extending to the curved surface of said chamber at one point thereon, whereby to form a seal, said impeller extending the entire distance between said chamber end walls; a fluid inlet for said chamber; and means for securing exterior fluid conduits to said wall passage and said fluid inlet.

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