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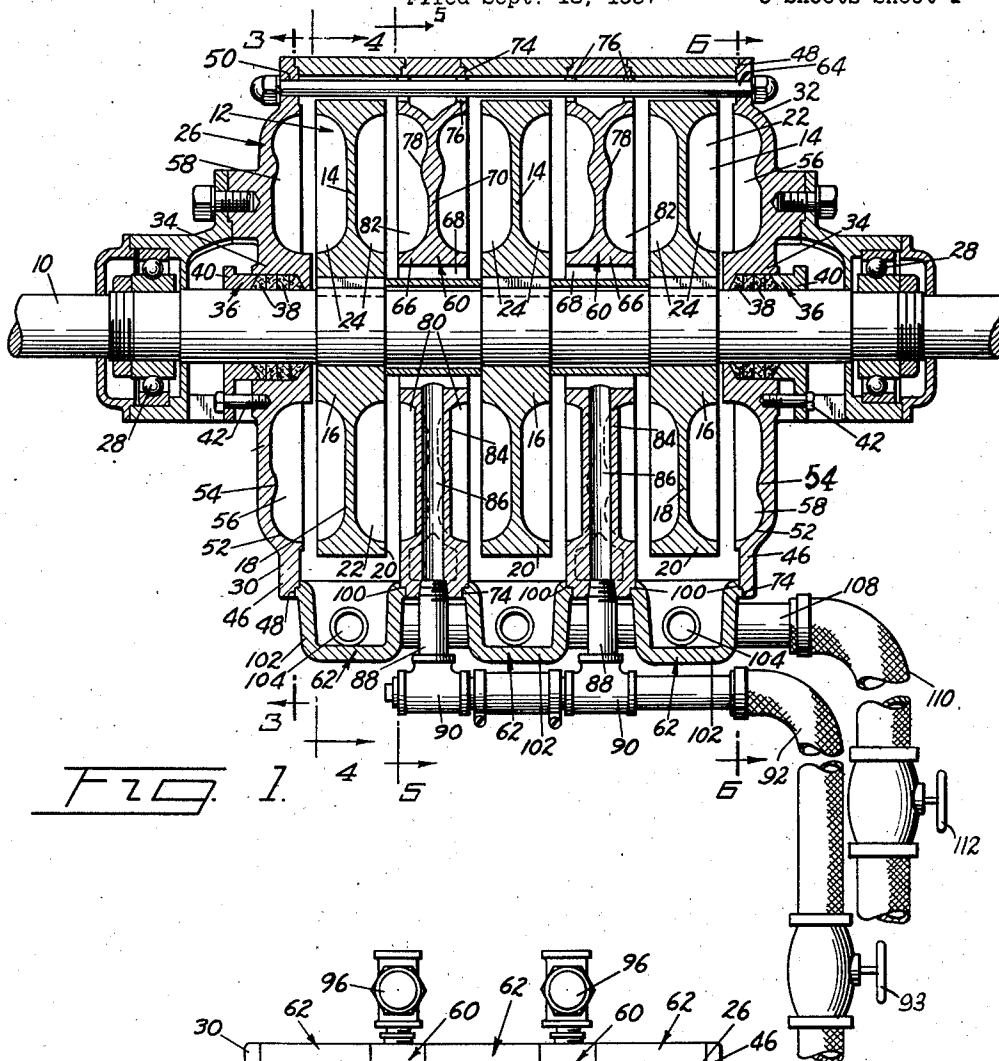
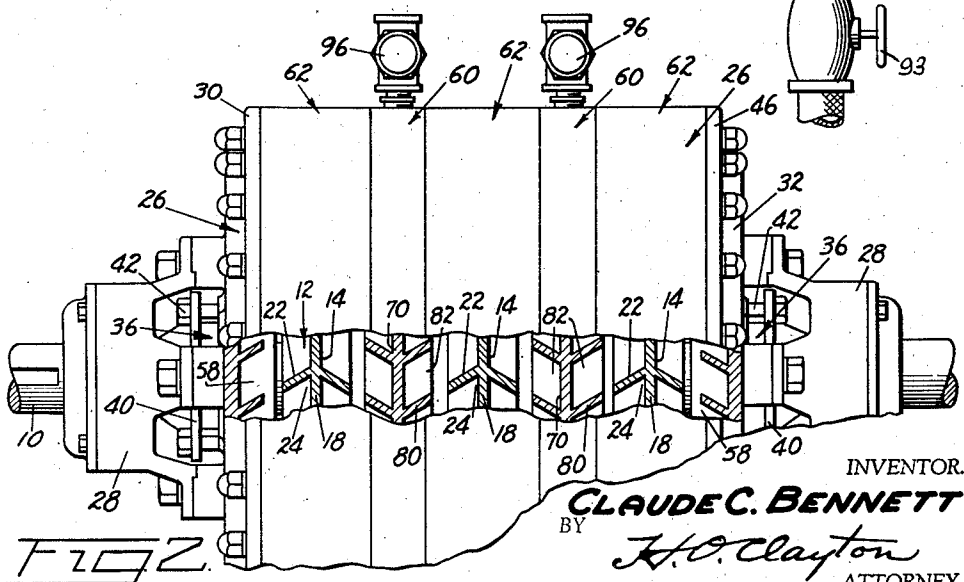
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ABSORPTION DYNAMOMETER

Filed Sept. 18, 1937

3 Sheets-Sheet 1



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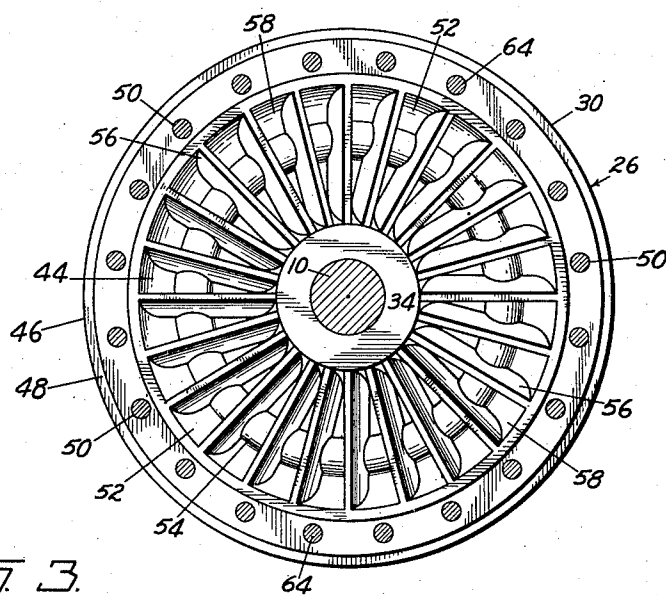


FIG. 3.

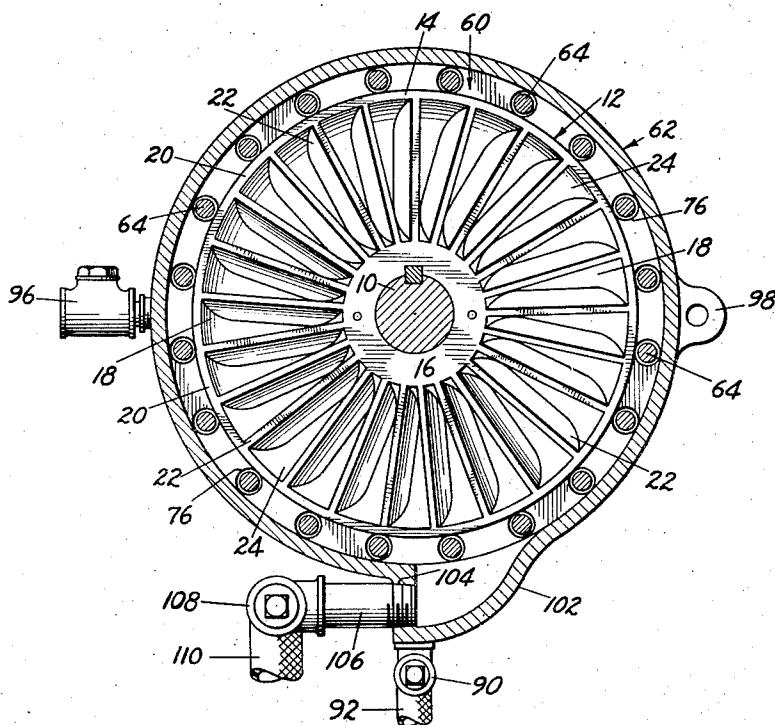


FIG. 4.

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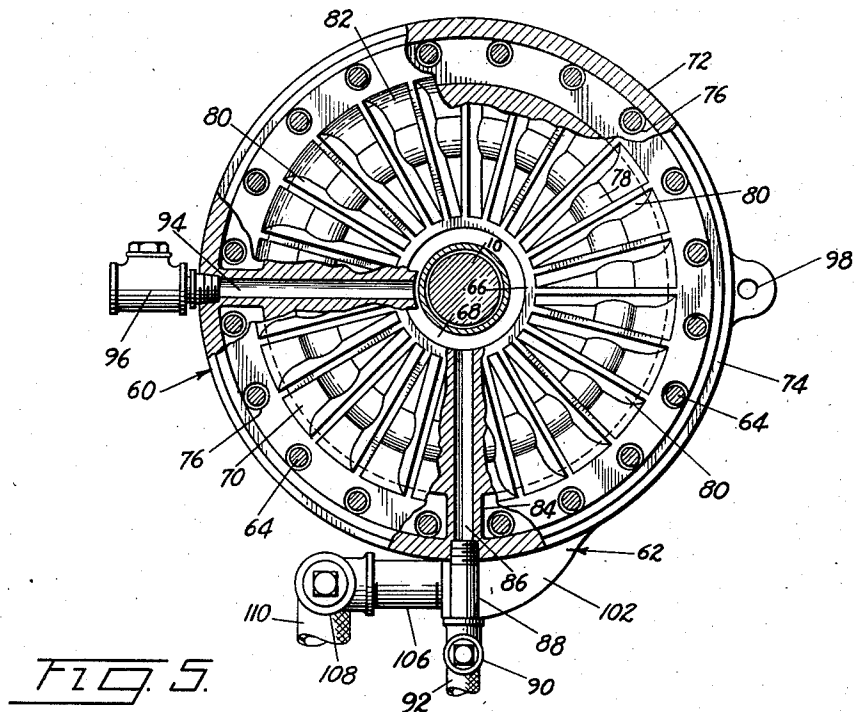
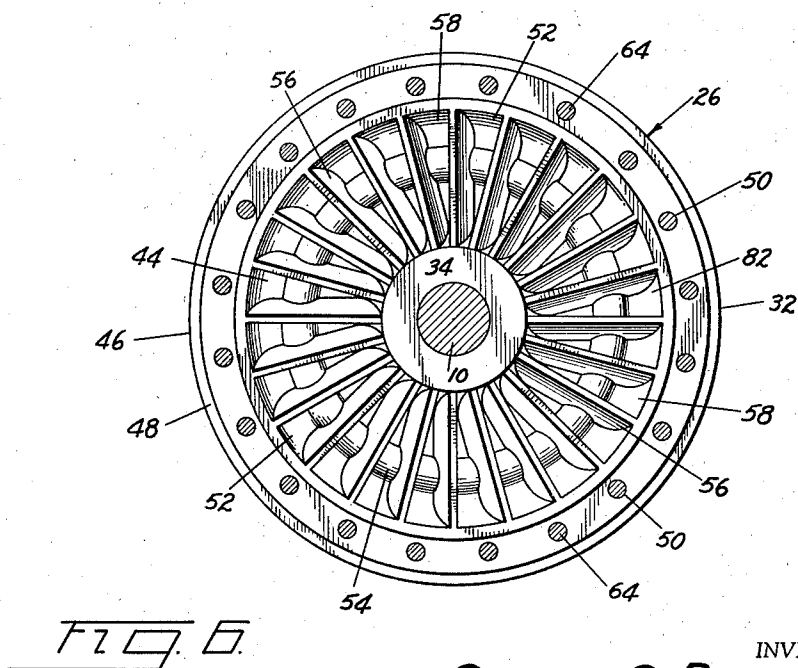
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ABSORPTION DYNAMOMETER

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3 Sheets-Sheet 3



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2,189,189

ABSORPTION DYNAMOMETER

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13 Claims. (Cl. 188—90)

This invention relates to dynamometers, and more particularly to absorption dynamometers.

An object of the invention is to increase the efficiency and, more particularly, the energy absorbing capacity of a dynamometer.

Another object of the invention is to provide a dynamometer in which friction may be reduced to a minimum.

Another object of the invention is to provide a dynamometer operative to build up any desired load, to maintain a true and steady torque, and to properly dissipate the heat generated.

A further object of the invention is to provide a dynamometer of the absorption type having but few parts of simple structure assembled in compact form so that the dynamometer as a whole may occupy but a small space.

Other objects of the invention will become apparent from the ensuing description of an embodiment of the invention illustrated in the following drawings, in which,

Fig. 1 is a vertical sectional view of a dynamometer embodying the invention;

Fig. 2 is a side elevation of the dynamometer, partly broken away and partly in section;

Fig. 3 is a sectional view substantially on line 3—3 Fig. 1;

Fig. 4 is a sectional view substantially on the line 4—4, Fig. 1;

Fig. 5 is a sectional view substantially on line 5—5, Fig. 1; and

Fig. 6 is a sectional view substantially on line 6—6, Fig. 1.

Referring to the drawings for more specific details of the invention, 10 represents a rotatable shaft adapted to be driven by an engine, a motor, or other apparatus, the torque or other characteristics of which it is desired to ascertain. The shaft has keyed or otherwise secured thereon a rotor indicated generally at 12 including a plurality of blades 14 arranged in spaced relation to one another.

Each of the rotor blades 14 includes a hub 16 having an axial bore for the reception of the shaft 10, an annular web 18 formed centrally of the hub, a substantial rim 20 on the web, and corresponding groups of radial vanes 22 arranged in oppositely disposed relation to one another on the respective sides of the web. The vanes are formed integral with the hub, the web, and the rim, and are inclined outwardly from the web so as to provide pockets 24, and the edges of the vanes included in the respective groups are in planes common to the respective ends of the hub and the edges of the rim.

A stator 26 encasing the rotor 12 is mounted for oscillation on the shaft 10. As shown, suitable bearings 28 arranged in spaced relation to one another on the shaft 10 support corresponding oppositely disposed end plates 30 and 32. Each of the end plates includes a hub 34 having an axial bore for the reception of the shaft 10, and a stuffing box 36 having therein packing rings 38 secured in place by a retaining nut 40 held against displacement as by bolts 42.

The end plates 30 and 32 are each provided with a rim 46 in a plane substantially centrally of the hub 34, and the rim 46 is provided with an annular shoulder 48 and a plurality of spaced openings 50. The inner face of the end plates 30 and 32 are dished as at 52, and formed on the dished face is a raised portion 54 substantially semi-elliptical in cross-section; and a plurality of vanes 56 formed integral with the hub and the rim provide in conjunction with the annular raised portion or circumferential boss 54, divided pockets 58.

As illustrated in Figs. 3 and 6, the radial vanes on the plate 30 are arranged in oppositely disposed relation to the radial vanes on the end plate 32, and the vanes of the respective end plates are reversely disposed to the vanes 22 on the adjacent rotor blades 14.

Stator plates 60 and spacer rings 62 are arranged in alternating relation to one another between the end plates 30 and 32, and transverse rods 64, extending through the openings 50 in the rims of the end plates, openings in the rims of the stator blades, and through the spacer rings, serve to fixedly secure these parts together.

Each of the stator plates 60 includes a hub 66 having an axial bore 68 for the reception of the shaft 10 with substantial clearness providing for the free passage of fluid through the hub, and formed integrally with and centrally of the hub is a web 70, provided with a rim 72 having an annular shoulder 74 on its respective edges, the purpose of which will hereinafter appear, and spaced openings 76 for the reception of the rod 64.

The web 70 has an enlarged annular portion substantially elliptical in cross-section providing an annular semi-elliptical circumferentially extending raised surface 78 on both sides of the web, and corresponding groups of radial vanes 80 formed on both sides of the web 70 extends between the hub 66 and the rim 72 to provide, in conjunction with the raised annular circum-

ferentially extending surface or bosses 78, divided pockets 82.

The vanes 80 in the respective groups carried by the web 70 incline outwardly from the web in directions reversely disposed to the vanes on the adjacent rotor blades 14, and the edges of the vanes 80 in the respective groups are in planes common to the respective ends of the hub 66 and the respective edges of the rim 72.

The webs 70 of the stator plates 60 are each provided with radial ribs 84, one of which is bored to provide a fluid delivery passage 86 extending from the axial bore 68 of the hub 66 through the rim 72, and secured in the outer end of this passage is a nipple 88 connected by suitable fittings 90 and a flexible hose 92 to a suitable source of water supply controlled as by a conventional valve 93. The other rib 84 is bored to provide an air intake passage 94 controlled as by a valve 96, and formed on one of the rims 72 of the stator plates 60 is a lug 98 for the attachment of a torque rod, not shown.

Each of the spacer rings 62 encircle one of the rotor blades 14, and each ring has on its respective edge corresponding annular shoulders 100 complementary to the annular shoulders 48 of the adjacent end plates 30 and 32 and the annular shoulders 74 on the adjacent stator plates 60 so as to interlock and completely seal the stator casing. Each of the spacer rings 62 has an offset portion 102 provided with an outlet opening 104 having secured therein a nipple 106 connected by suitable fittings 108 and a flexible hose 110 to a suitable drain with a conventional valve 112 interposed for controlling the outlets.

In operation, the shaft 10, carrying the rotor 12 and oscillably supporting the stator 26 is connected at one end, preferably by a universal joint, to the crank shaft of an engine, motor, or other apparatus, the torque or other characteristics of which it is desired to test. The other end of the shaft is suitably connected through a conventional tachometer for indicating the speed of the shaft, and consequently the speed of the engine; any suitable type of pressure gauge, preferably calibrated in units of torque, is connected through a torque rod or other linkage to the stator.

When the dynamometer is connected to the engine and gauges as hereinabove described, the operator opens the outlet valve and closes the inlet valve, and the engine, motor, or other apparatus under test is then set in motion. After operating for a sufficient period of time to completely displace all fluid or water from the casing, the outlet is closed and the inlet gradually opened. The engine under test is then speeded up, and maintained at a constant rate of speed. The intake valve is then opened gradually until the torque gauge connected to the stator begins to indicate pressure.

When the water is admitted into the casing and distributed between the stator plates 60 and rotor blades 14, it is projected by centrifugal force outwardly toward the periphery of the casing. Due to the vanes on the respective stator plates and rotor blades, and particularly their opposed relation to one another, the water is agitated to a very high degree; and because of the structure of the stator plates, particularly the annular semi-elliptical circumferentially extending surfaces or bosses 78 on the respective sides thereof, providing in conjunction with the vanes 80 divided pockets 82, back eddies of water are

created resulting in intensifying the turbulence of the water.

The annular circumferentially extending bosses 78 carried by the stators 14, and the annular circumferentially extending bosses 54 carried by the end plates 30 and 32 break up the smooth flow of liquid thereby creating turbulence to increase the efficiency of the dynamometer as an energy absorbing device. The relative direction of liquid flow will of course be dependent in part upon the quantity of liquid in the unit and the speed of operation thereof. The resistance or energy absorbing characteristics of the dynamometer increases as the quantity of liquid therein is increased.

When releasing the water from the resistance unit to decrease the torque or lower the power absorption thereof, the creation of a partial vacuum may result, and to overcome this the stator plates are equipped with air inlets 94 extending from the periphery to the central portion and controlled by air check valves 96 opening toward the central portion of the dynamometer. The load on the engine may be varied by operating the liquid inlet and outlet controls of the dynamometers, and the speed of the engine may be governed by operating the conventional engine controls, and through the medium of a definitely fixed water flow through the inlet and outlet valves, the heat is dissipated, permitting a continuous test over an unlimited period of time. The resistance or load on the engine may be varied by regulating the rate of discharge of water from the dynamometer casing, or by regulating the rate of admission of water into the dynamometer casing. In completing the test, the engine is operated with wide open throttle and the control of the dynamometer set so as to maintain a constant resistance or load on the engine. Under these conditions, the operator takes a reading of the tachometer and of the torque gauge (not shown), and with these two factors known the horse power of the engine may be computed in accordance with established practice.

Although this invention has been described in connection with certain specific embodiments, the principles involved are susceptible of numerous other applications that will readily occur to persons skilled in the art. The invention is, therefore, to be limited only by the scope of the appended claims.

Having thus described the various features of the invention, what I claim as new and desire to secure by Letters Patent is,

1. A dynamometer comprising a plurality of stator plates each having radially extending vanes, a circumferentially extending raised surface on the plates partially intersecting the vanes, and a plurality of rotor blades alternating with the stator plates each having radially extending vanes for cooperation with the vanes and raised portions on the adjacent stator plates.

2. A dynamometer comprising corresponding end plates, an assembly of stator plates each having radially extending vanes and a circumferentially extending raised surface partially intersecting the vanes, and spacer rings arranged alternately between the end plates, and rotor blades alternating with the stator plates, and provided with a plurality of vanes forming single radially extending pockets therebetween.

3. A dynamometer comprising a shaft, corresponding end plates oscillable on the shaft, stator plates and spacer rings arranged alternately between the end plates and providing in conjunc-

tion therewith a casing, means to admit water near the center of the casing, means to discharge water near the outside of the casing, rotor blades alternating with the stator plates, and means for controlling the water inlets and outlets.

4. A dynamometer comprising a rotatable shaft, corresponding end plates oscillable on the shaft, radial vanes on the end plates, a plurality of corresponding stator plates, radially extending vanes on the sides of the stator plates, spacer rings alternating with the stator plates, said stator plates and spacer rings interlocking with one another and with the end plates and providing in conjunction therewith a casing, means to admit liquid near the center of the casing, means to discharge liquid from near the outer edge of the casing, rotor blades on the shaft alternating with the stator blades, and means controlling the liquid inlet and outlet.

5. A dynamometer comprising a rotatable shaft, corresponding end plates oscillable on the shaft, radially extending vanes on the end plates inclined outwardly therefrom and partially intersected by a circumferentially raised surface on the plate, the vanes and raised surface on one of the end plates being reversely disposed to the vanes and raised surfaces on the other end plate, an assembly of stator plates and spacer rings clamped between the end plates and providing in conjunction therewith a casing having liquid inlets and outlets, radially extending vanes on the sides of the stator plates and circumferentially extending raised surfaces partially intersecting the vanes, rotor blades on the shaft alternating with the stator plates, radially extending vanes on the rotor blades reversely disposed to the vanes on the adjacent stator plates, and means for controlling the inlets and outlets.

6. A dynamometer comprising a rotatable shaft, spaced annular end plates oscillable on the shaft, radial vanes on the end plates inclined outwardly therefrom, circumferentially extending raised surfaces on the plates partially intersecting the vanes, an assembly of annular stator plates and spacer rings clamped between the end plates and providing in conjunction therewith a casing having inlets and outlets, radial vanes on the stator plates inclined outwardly therefrom, circumferentially extending raised surfaces on the stator plates partially intersecting the vanes, rotor blades on the shaft alternating with the stator plates, radial vanes on the rotor blades inclined outwardly therefrom, and means for controlling the inlets and outlets.

7. A dynamometer comprising a rotatable shaft, spaced annular end plates oscillable on the shaft, radial vanes on the end plates inclined outwardly therefrom, the vanes on one of the end plates being reversely disposed to the vanes on the other end plate, an assembly of stator plates

and spacer rings clamped between the end plates and providing in conjunction therewith a casing, each of the spacer rings having a discharge port, radial vanes on the stator plates inclined outwardly therefrom, the vanes on one side of the stator plates being reversely disposed to the vanes on the other side thereof, each of the stator plates having a liquid intake passage and an air intake passage, both passages extending from the periphery of the plate inwardly and opening adjacent the shaft, rotor blades on the shaft alternating with the stator plates, radial vanes on the sides of the rotor blades inclined outwardly, the vanes on one side being reversely disposed to the vanes on the other side, valves controlling the air inlets, and means for controlling the fluid inlet and outlet.

8. A dynamometer comprising a stator plate including a hub, a web carried by the hub, a rim carried by the web, an enlarged annular circumferentially extending boss intermediate the hub and web, and radial vanes on the web.

9. A dynamometer comprising a stator plate including a hub, a web carried by the hub, a rim carried by the web, an annular circumferentially extending raised surface or boss on each side of the web, and radially extending vanes integral with the web and extending from the hub to the rim.

10. A dynamometer comprising a stator plate including a hub, a web on the hub, an annular circumferentially extending raised surface or boss on each side of the web, a rim on the web, and radial vanes on the web inclined outwardly therefrom and connecting the hub and the rim.

11. A dynamometer comprising a stator plate including a hub, an annular web disposed centrally on the hub, an annular semi-elliptical circumferentially extending boss on each side of the web, a rim on the web, and radial vanes on the sides of the web inclined outwardly therefrom and connecting the hub and the rim.

12. A dynamometer comprising a stator plate including a hub, an annular web disposed centrally on the hub, an annular raised boss on each side of the web, a rim on the web, and radially extending vanes on the sides of the web inclined outwardly therefrom and connecting the hub and the rim.

13. A dynamometer comprising a stator plate including a hub having an axial bore, a web disposed centrally on the hub, an annular raised circumferentially extending boss on the sides of the web, a rim on the web, radial passages in the stator plate extending from the axial bore to the periphery thereof, and radial vanes on the sides of the web inclined outwardly therefrom and connecting the hub and the rim.