Sept. 25, 1928. 1,685,735

G. H. WALKER

HYDRAULIC DYNAMOMETER

Filed March 31, 1927 3 Sheets-Sheet 1

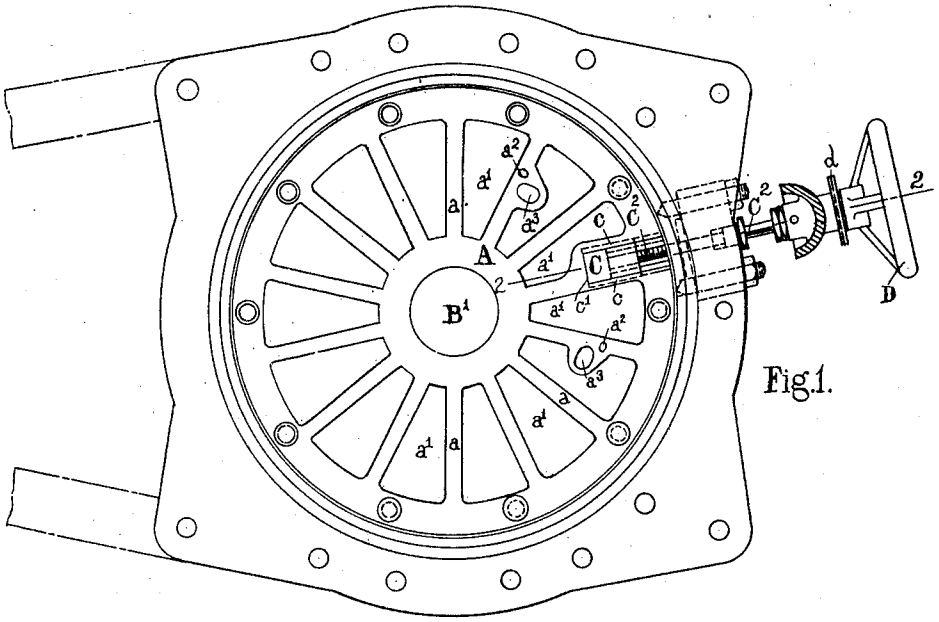


Fig.1.

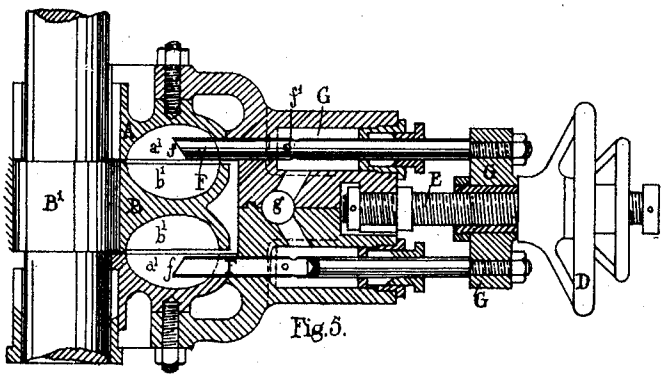


Fig.5.

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3 Sheets-Sheet 2

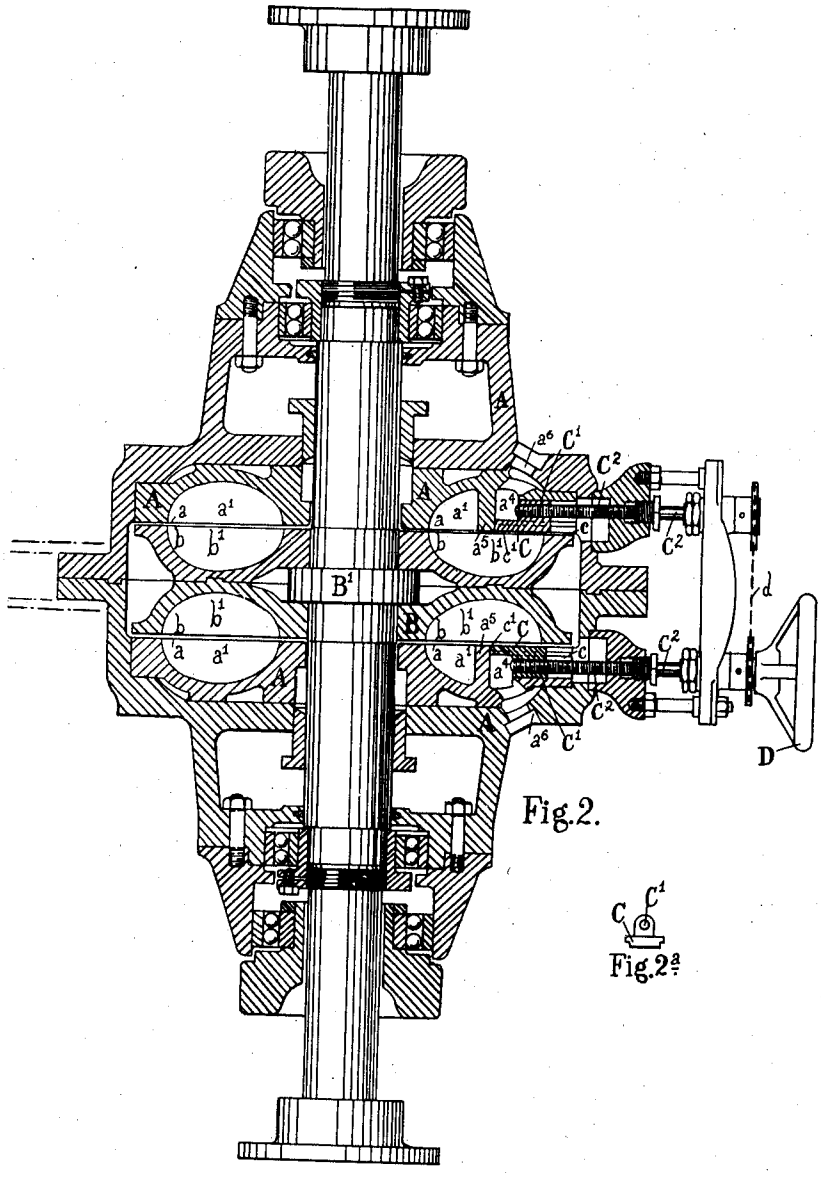


Fig.2.

Fig.2a.

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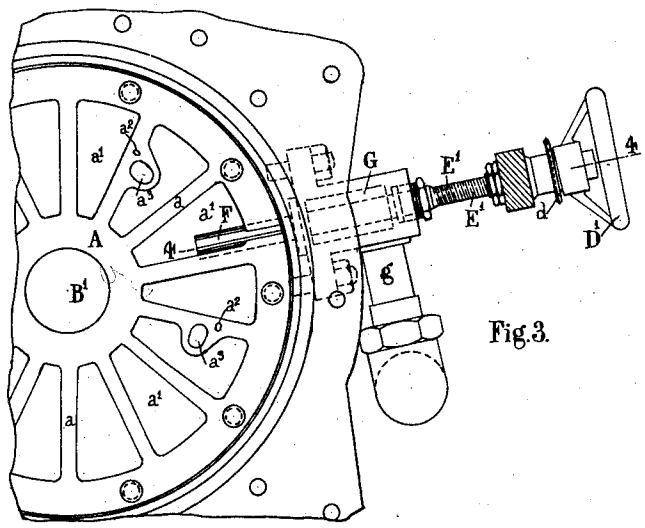


Fig.3.

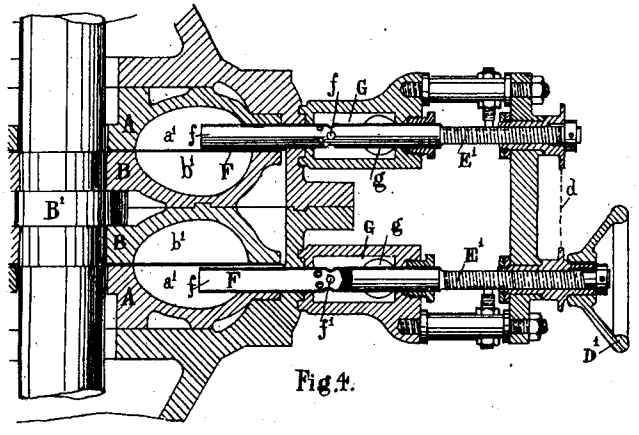


Fig.4.

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UNITED STATES PATENT OFFICE.

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HYDRAULIC DYNAMOMETER.

Application filed March 31, 1927, Serial No. 180,019, and in Great Britain September 1, 1926.

This invention relates to improvements in hydraulic dynamometers and more particularly to improvements in hydraulic dynamometers of the type in which air and water passages are formed in the vanes of the stator such as described in the specification of the prior U. S. Patent No. 1,035,700 of F. Harrison.

In a dynamometer of this type motion is imparted to the water contained in the machine on the rotation of the rotor and there is set up in each pocket or cup of the rotor and casing a vortex which rapidly consumes power. The velocity and pressure of the water are greatest at the periphery of the pockets or cups whilst at the centre, where the velocity and pressure is the least, there is a tendency to form a vacuum, and if air be admitted at this point the vortex will cavitate, i. e. form a cavity, and consequently the radial depth of the water measured from the centre of the vortex will decrease. As the hydraulic resistance to rotation of the water is approximately proportional to the radial depth of water it will be seen that by reducing this depth to a very small amount the consumption of power can be reduced to a minimum.

Under normal running conditions the radial depth of water, and therefore the hydraulic resistance, are influenced both by the rate at which water is supplied to the pockets or cups and by the rate at which it leaves, and consequently if the rate of egress exceeds that of ingress the resistance will gradually disappear. When using the form of dynamometer described in the previous United States Patent No. 1,035,700 in which the depth of water forming the vortex in each pocket or cup is regulated by means of valves on the inlet or outlet of the casing, it has been found that in absorbing the power developed by certain forms of engines there is a tendency for the pockets or cups to empty themselves and allow the engine to race. This feature is partly attributable to the fact that the pressure of water arising in the casing from the destruction of power is sufficient to force the water at a more rapid rate out of the casing than that at which it enters the pockets or cups.

According to the present invention in a dynamometer of the type referred to, the radial depth of water forming the vortex in the pockets or cups is positively regulated independently of the rate of supply thereto by causing the waste water to flow from the pockets or cups over a weir or similar device, the depth of which can be regulated.

The invention will be described with reference to the accompanying drawings.

Fig. 1 is a transverse section through a dynamometer showing one form of the invention applied thereto.

Fig. 2 is a section on line 2—2 Fig. 1.

Fig. 2ª is a front elevation of sliding plate C.

Fig. 3 is a transverse section through a dynamometer showing another form of the invention applied thereto.

Fig. 4 is a section on line 4—4 Fig. 3.

Fig. 5 is a section showing modified arrangement for operating the tubes F or plates C.

The dynamometer is of the type described in United States Patent No. 1,035,700 having a stator A formed with vanes a forming pockets or cups a^1 and a rotor B formed with two sets of vanes b forming pockets or cups b^1, air passages a^2 and water passages a^3 being provided in one or more of the vanes a of the stator.

In the form of the invention shown in Figs. 1 and 2, one of the pockets or cups a^1 in the stator is provided with guides c radiating outwards from a point approximately corresponding with the centre of the vortex. A plate C capable of being moved radially is fitted into the guides c.

When the plate C is in the "closed" position it presents a blank face to the vortex and the position of its inner edge or face c^1 is approximately the same as the centre of the vortex. By sliding the plate C so that the edge c^1 recedes from the center of the vortex, the edge c^1 forms a weir over which part of the water forming the vortex may spill into the chamber, a^4, formed in the pocket or cup a^1 by the web or flange a^5. The chamber a^4 is connected by the passages a^6 with the drain or outlet for the water.

Thus the rate of supply of water to the pockets or cups a^1, b^1 does not materially affect the radial depth of the water forming the vortex since such radial depth is fixed by the position of the edge c^1 of the sliding plate C and any surplus water which cannot be contained in the vortex passes over the edge of the weir into the chamber a^4

and passes away through the passages a^6. The sliding plate C is preferably so arranged that when in its extreme "open" position there is practically no radial depth of water in the vortex.

The sliding plate C may be moved in its guide in any suitable way such as by a hand wheel D operating a screw C^2 working in a nut C^1 carried on the plate. Where two sliding plates C are employed as shown in the drawings, one in either half of the dynamometer, the screws operating them are coupled together by chain gearing *d* or other mechanism so that they may be operated simultaneously.

In the form of the invention shown in Figs. 3 and 4 the sliding plate is replaced by a hollow tube F having an open end *f*. The hollow tube projects into the pocket or cup a^1 and can be moved radially therein, the uppermost position of its open end *f* corresponding approximately with the position of the centre of the vortex.

The end *f* can be moved radially outwards from this position so that its position will fix the radial depth of water forming the vortex, and the surplus water due to the incoming supply escapes through the tube and the apertures f^1 at the outer end thereof into a chamber G from which it escapes through suitable ports or passages *g* to the drain or water outlet.

The hollow tube F may be moved radially in any desired way as by a hand wheel D^1 the rotation of which causes the longitudinal movement of the screw E^1 affixed to the end of the tube F. Where two hollow tubes F are employed as shown in the drawings, one in either half of the dynamometer, the nuts operating the screws E^1 are coupled together by chain gearing *d* or other mechanism so that they may be operated simultaneously.

In the construction shown in Fig. 5 the tubes F are connected to a bridge piece G which is moved by a hand wheel D and single screw E.

The invention has been described above with reference to a dynamometer in which the radial depth of water forming the vortex in all the pockets or cups is controlled by two devices each operating on one pocket or cup. As it has been found that the radial depth of the water remains approximately uniform throughout all the pockets or cups in the rotor and stator even though the depth is controlled in one pocket or cup only, provided that the water can communicate freely between all the pockets or cups, one of the devices described above may be dispensed with, and the radial depth of the water in all the pockets or cups of the dynamometer may be controlled by a single device operated on one pocket or cup only. But it is to be understood that the radial depth of water may be controlled by one or any convenient greater number of such devices suitably arranged around the dynamometer.

What I claim as my invention and desire to protect by Letters Patent is:—

1. In an hydraulic dynamometer of the type referred to having pockets formed between the vanes of the stator and rotor the combination with said vanes of depth controlling devices arranged in said pockets and means for moving said devices radially, whereby the radial depth of water forming the vortex in the pockets can be positively regulated independently of the rate of supply of water to the pockets.

2. In an hydraulic dynamometer of the type referred to having pockets formed between the vanes of the stator and rotor the combination with said vanes of a weir arranged in one of the pockets, and means for moving said weir radially whereby the radial depth of water forming the vortex in the pockets can be positively regulated independently of the rate of supply of water to the pockets.

3. In an hydraulic dynamometer of the type referred to having pockets formed between the vanes of the stator and rotor, the combination with said vanes of a weir arranged in a plurality of the pockets, and means for moving said weirs radially whereby the radial depth of water forming the vortex in the pockets can be positively regulated independently of the rate of supply of water to the pockets.

4. In an hydraulic dynamometer of the type referred to, having pockets formed between the vanes of the stator and rotor the combination with said vanes of a sliding hollow tube arranged in one of the pockets, and means for moving said tube radially whereby the radial depth of water forming the vortex in the pockets can be positively regulated independently of the rate of supply of water to the pockets.

5. In an hydraulic dynamometer of the type referred to having pockets formed between the vanes of the stator and rotor the combination with said vanes of sliding hollow tubes arranged in a plurality of the pockets, and means for moving said tubes radially whereby the radial depth of water forming the vortex in the pockets can be positively regulated independently of the rate of supply of water to the pockets.

In testimony whereof I have hereunto set my hand.

GEORGE HENRY WALKER.