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MEANS FOR MINIMIZING FLUID PULSATIONS

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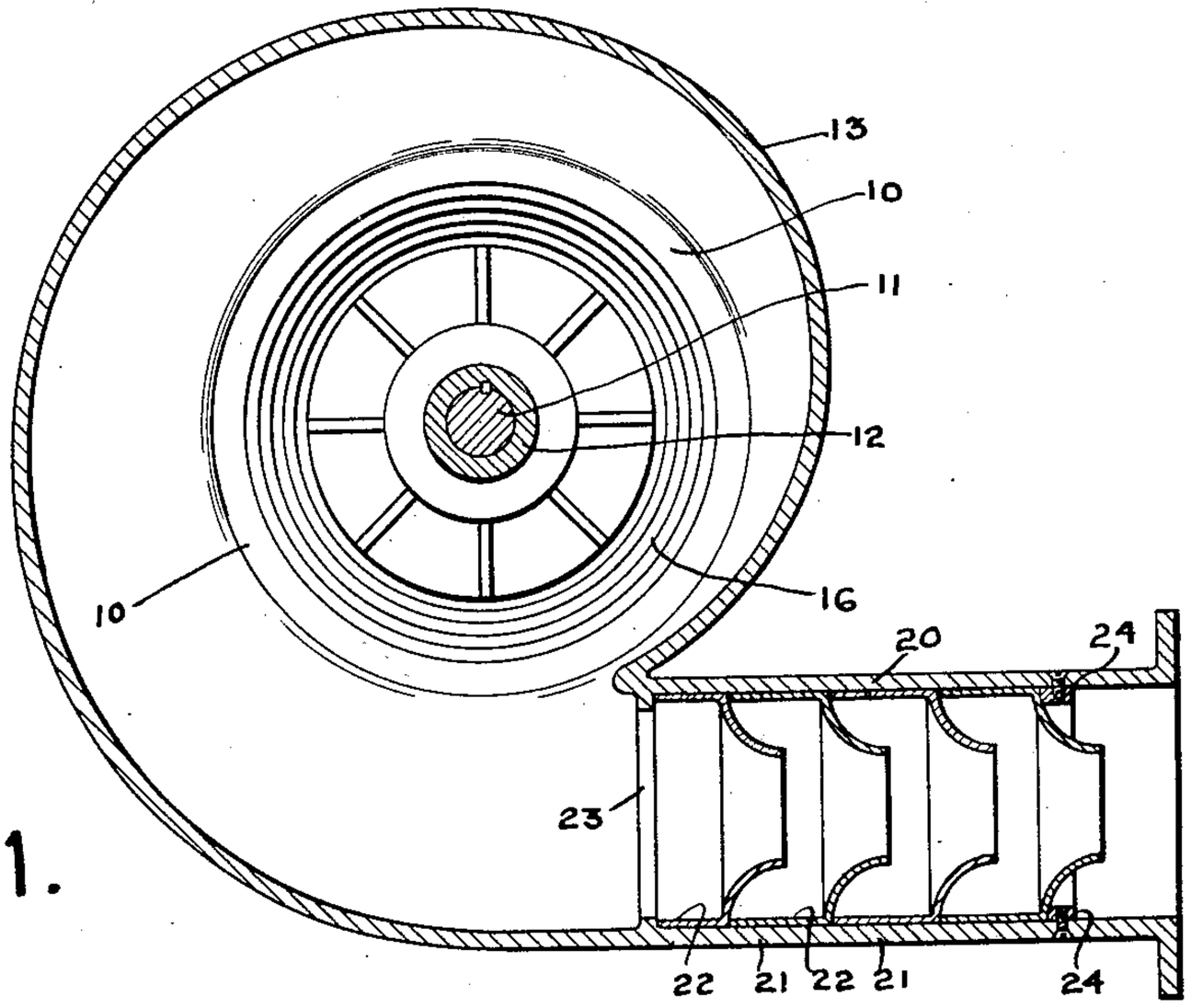


Fig. 1.

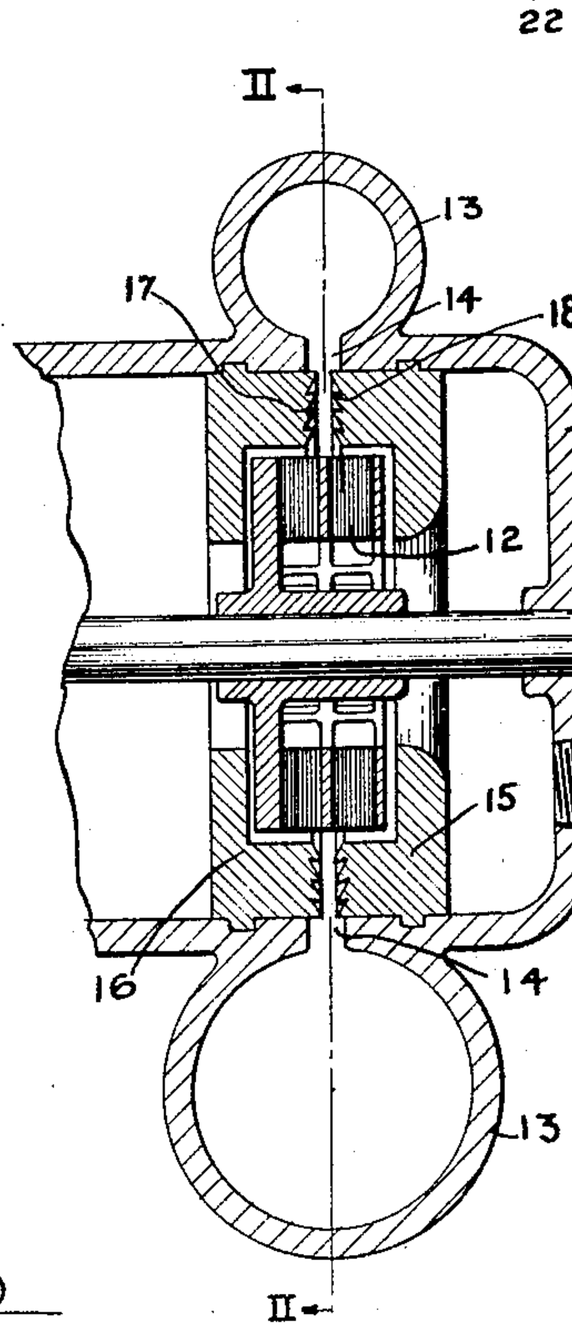


Fig. 2.

WITNESSES:

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UNITED STATES PATENT OFFICE.

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MEANS FOR MINIMIZING FLUID PULSATIONS.

Application filed May 28, 1925. Serial No. 33,415.

My invention relates to a method of and apparatus for minimizing fluid pulsations and it has for its object to dampen out the effect of fluid pulsations where it is desired to secure a supply of fluid at substantially uniform pressure from a source of pulsating pressure.

More specifically my invention relates to means for obtaining fluid pressure substantially free from pulsations from an impeller pump for the operation of sensitive apparatus such, for example, as a turbine governor.

In the accompanying drawing, Fig. 1 is a side view, in section, of an impeller pump provided with damping means constructed in accordance with my invention; and Fig. 2 is a sectional view of the pump shown in Fig. 1, being taken on the plane II—II.

It has been proposed to operate the governors of fluid pressure turbines by means of fluid pressure, generally oil, said pressure being generated by a multi-vane runner carried by or mechanically connected to the shaft of the turbine.

I find that unless an excessive and impracticable number of vanes are employed, there exists in the discharge column a slight pressure pulsation which may produce undesired vibration in the governing means, particularly if one or more members of such governing means have a natural period approximating the fundamental or an upper harmonic of the pulsating waves.

In order to obviate this undesirable result, I provide conduit means both within and external to the pump, through which the discharge of the pump is caused to flow. The walls of these conduit means are so formed as to define a plurality of successive discharge nozzles, each of which has a radically different discharge co-efficient in one direction than in the opposite direction. It follows that said pulsations are thus smoothed out and a substantially uniform pressure is secured for application to the governor. Preferably these discharge orifices have a relatively great discharge co-efficient in the direction of fluid flow and a relatively low discharge co-efficient in a counter direction, thus offering but little or no impediment to a free discharge of fluid.

By my use of the term "uniform" as applied to the resultant pressure, it will be understood that I am merely damping out the undesired high frequency pulsations, it being obvious to those skilled in the art that the apparatus proposed by me has but little or no effect on those slow changes in fluid pressure attendant upon a variation in turbine speed, use being made of the latter type of pressure changes to control the governor.

Referring to the drawing for a more detailed understanding of my invention, I show a pump casing at 10 in Fig. 1, this casing being, for example, an extension of an ordinary turbine casing.

A shaft 11 projects through the casing 10 and may be, for example, an extension of the turbine shaft. This shaft carries a pump runner 12, shown in Fig. 2 as of the radial vane type having eight vanes.

A volute casing 13—13 is formed on the casing 10 and communicates with the interior thereof through an annular port 14—14 opposite the central portion of the runner 12.

Fixedly mounted on the casing 10 and interposed between said casing and the runner 12 is a pair of rings 15 and 16 which closely abut at their opposing faces, but nevertheless define a narrow discharge passage from the runner 12 to the passage 14—14. The abutting faces of the rings 15 and 16 are provided with a plurality of annular flanges and, as shown, the inwardly presented faces 17—17 of said flanges define an angle approaching 90° with the axis of the runner 12, whereas the outwardly presented faces 18—18 define a relatively small angle with the axis of the runner 12, and these faces may actually be undercut as shown.

The volute casing 13—13 discharges into a conduit 20 as shown in Fig. 2 and within this conduit is disposed a plurality of frusto-conical collars 21—21, each of which for ease and security of mounting is carried on a cylindrical collar 22. These collars may be retained in the conduit 20 as by being stacked between a suitable flange 23 and removable fastening means 24—24.

Having thus described the structure of apparatus constructed in accordance with my invention, the operation is as follows: A suitable fluid, such as oil, is supplied to the interior of the casing 10 as through a conduit 25 and passes into the inner portion of the runner 12 whence it is thrown outwardly through the blades of said runner and passes via the discharge passage defined

by the rings 15 and 16 and the passage 14—14 to the volute casing 13, whence it traverses the conduit 20 to any desired load device. The action of the vanes of the runner 12 is to cause a slight pulsation in the discharge pressure but, as the fluid subject to such pulsation passes through the succession of annular discharge nozzles defined by the flanges on the rings 15 and 16, the effect of these pulsations is largely damped out for the reason that by suitable choice of inclination of the faces 17 and 18, said nozzles may be given an outward discharge co-efficient of substantially 98%, whereas they may be given an inward discharge co-efficient of 50% or less.

Likewise the fluid stream subject to the residual pulsations in passing through the conduit 20 has said pulsations still further removed because the selection of a proper angle in the frusto-conical members 21—21 may give rise to a discharge co-efficient in the direction of flow of substantially 98% with a discharge co-efficient in the direction counter to the direction of fluid flow of 50% or less.

It will be obvious that the effect of pulsations would be effectively damped out by having the low co-efficient in the direction of fluid flow and the high co-efficient in the opposite direction, but such an arrangement would tend to set up an undesirable back pressure and greatly reduce the capacity of the device.

It will be noted that the discharge passage defined by the rings 15 and 16 is relatively narrow as compared with the width of the blades on the runner 12, and this is purposely so arranged that said discharge passage can accommodate only a small portion of the free discharge of the runner 12, it resulting that the fluid is retained in the runner 12 for several revolutions before escaping, thus being thoroughly freed of air before being discharged, for example, to a governor where such entrained air would interfere with successful operation.

This feature is not claimed herein but is specifically described and claimed an application of Roland Marsland, Serial No. 33,420, filed May 28, 1925, and assigned to the Westinghouse Electric and Manufacturing Company (Case 6235).

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. The combination with a pump comprising a central revoluble multi-vane runner and a volute discharge chamber surrounding said runner, of a pair of fixed juxtaposed rings interposed between said runner and said chamber and defining therebetween an annular discharge port, the juxtaposed faces of said rings being provided with opposing annular flanges, the inwardly presented faces of which define a different angle with the axis of said runner than do the outwardly presented faces, whereby a plurality of successive annular discharge nozzles is formed, each of which has a different discharge co-efficient in an outward direction than in an inward direction.

2. The combination with a pump comprising a central revoluble multi-vane runner and a volute discharge chamber surrounding said runner, of a pair of fixed juxtaposed rings interposed between said runner and said chamber and defining therebetween an annular discharge port, the juxtaposed faces of said rings being provided with opposing annular flanges, the inwardly presented faces of which define a greater angle with the axis of said runner than do the outwardly presented faces thereof, whereby a plurality of successive annular discharge nozzles is formed, each of which has a greater discharge co-efficient in an outward direction than in an inward direction.

3. The combination with a pump comprising a central revoluble multi-vane runner and a volute discharge chamber surrounding said runner, of a pair of fixed juxtaposed rings interposed between said runner and said chamber and defining therebetween an annular discharge port, the juxtaposed faces of said rings being provided with opposing annular flanges, the inwardly presented faces of which define an angle approaching 90° with the axis of said runner and the outwardly presented faces of which are undercut, whereby a plurality of successive annular nozzles is formed, each of which has a radically greater discharge co-efficient in an outward direction than in an inward direction.

4. The combination with a pump comprising a central revoluble multi-vane runner and a volute discharge chamber surrounding said runner, of a pair of fixed juxtaposed rings interposed between said runner and said chamber and defining therebetween an annular discharge port, the juxtaposed faces of said rings being provided with pairs of opposed annular flanges, said pairs of flanges defining successive annular discharge nozzles, each of said discharge nozzles having a different discharge co-efficient in an outward than in an inward direction.

5. The combination with a pump comprising a central revoluble multi-vane runner and a volute discharge chamber surrounding said runner, of a pair of fixed juxtaposed

rings interposed between said runner and said chamber and defining therebetween an annular discharge port, the juxtaposed faces of said rings being provided with pairs of opposed flanges, said pairs of flanges defining successive discharge nozzles, each of said discharge nozzles having a different discharge co-efficient in an outward than in an inward direction.

6. The combination with a pump comprising a central revoluble multi-vane runner and a volute discharge chamber surrounding said runner, of a pair of fixed juxtaposed rings interposed between said runner and said chamber and defining therebetween an annular discharge port, the juxtaposed faces of said rings being provided with pairs of opposed annular flanges, said pairs of flanges defining successive annular discharge nozzles.

In testimony whereof, I have hereunto subscribed my name this twentieth day of May, 1925.

HENRY F. SCHMIDT.