

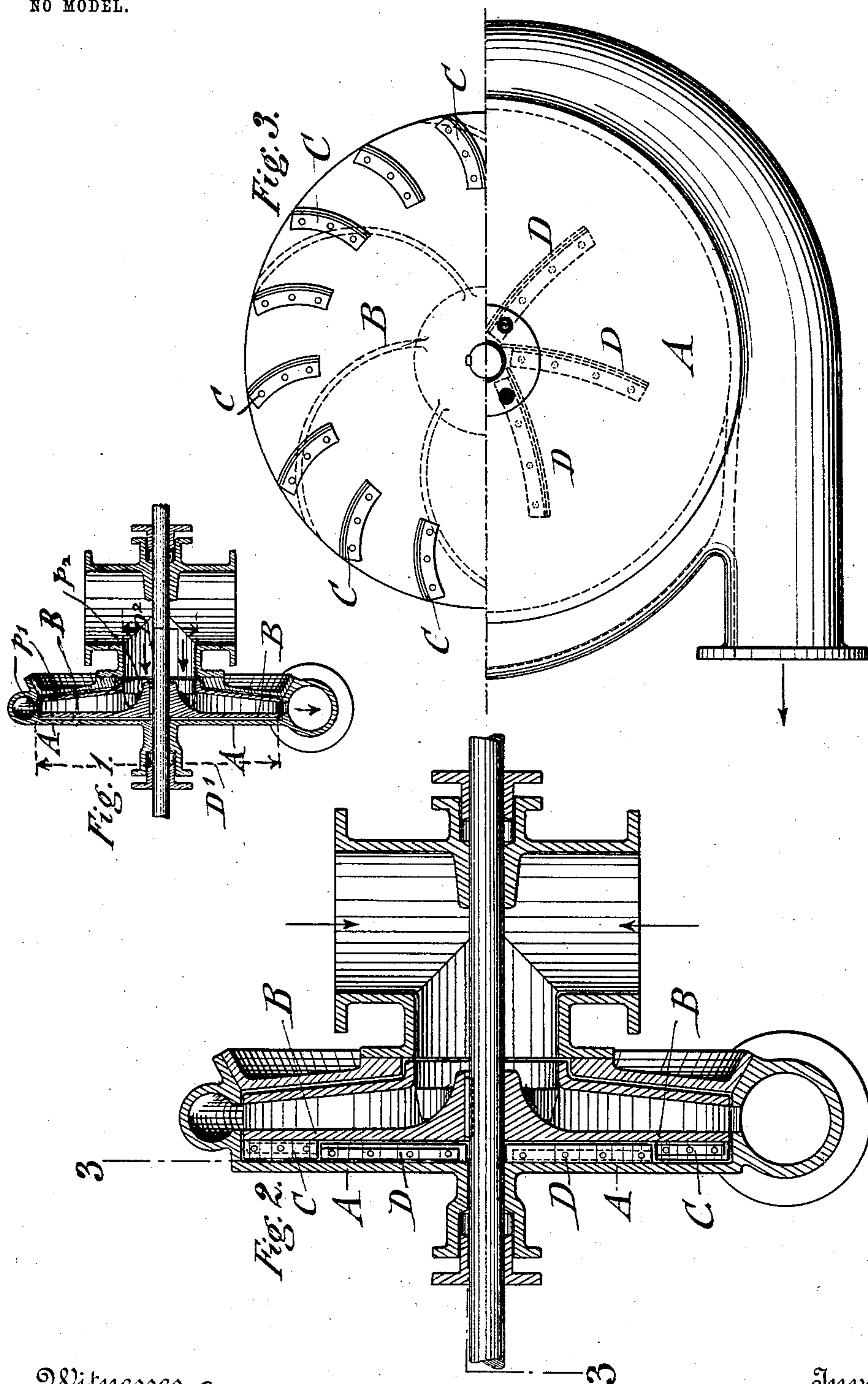
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PATENTED AUG. 30, 1904.

K. SCHOENE.  
CENTRIFUGAL PUMP.

APPLICATION FILED MAR. 18, 1904.

NO MODEL.



Witnesses  
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# UNITED STATES PATENT OFFICE.

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## CENTRIFUGAL PUMP.

SPECIFICATION forming part of Letters Patent No. 768,911, dated August 30, 1904.

Application filed March 18, 1904. Serial No. 198,728. (No model.)

*To all whom it may concern:*

Be it known that I, KURT SCHOENE, a citizen of the Empire of Germany, residing in Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification.

In designing centrifugal pumps, and especially those for high pressures, it is necessary to provide means by which the longitudinal thrust on the rotating wheel or runner is avoided. This thrust results from the inequality of the surfaces on which the same pressure acts. Supposing the outer diameter of the runner to be  $D_1$ , the outer diameter of the inlet  $D_2$ , the diameter of the shaft  $d$ , the water-pressure at the circumference of the runner  $p_1$ , and the inlet-pressure to be  $p_2$ , then the pressure of water at the inlet side of the runner can be expressed by the formula

$$\frac{\pi}{4} (D_1^2 - D_2^2) p_1 + \frac{\pi}{4} (D_2^2 - d^2) p_2.$$

The pressure on the opposite or off side will then be  $\frac{\pi}{4} (D_1^2 - d^2) p_1$ . In calculating this pressure allowance must be made for the deflection of the entering water, which in passing from an axial to a radial direction causes a certain loss of pressure and a correspondingly-decreased longitudinal thrust.

The object of this invention is therefore to obviate the resulting overpressure on the incoming side of the runner of the pump; and for this purpose the invention consists of a centrifugal pump, the runner of which is provided on its off side—that is to say, on the side opposite to the entrance side of the water—with vanes of a certain length of approximately radial direction extending inwardly from the circumference of the runner or from a circle of a smaller diameter than that of the runner, said vanes coöperating with vanes on the casing for imparting centrifugal force to the water and producing a reduction of the pressure.

In the accompanying drawings, Figure 1 represents a vertical central section of a centrifugal pump of the ordinary construction.

Fig. 2 is a vertical central section of a centrifugal pump made according to my improved construction; and Fig. 3 in its upper half represents a vertical section on line 3 3, Fig. 2, and in its lower half a side elevation of the same.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the casing, and B the runner, of a centrifugal pump of any approved construction. The runner B is provided at its off side—that is to say, at the side opposite to the entrance of the water—with vanes C, which extend inwardly from the circumference or from a circle of smaller diameter, approximately in radial direction to a certain distance toward the center. The vanes C may be made either curved, as shown in Fig. 3, or straight, as desired. The vanes are riveted or otherwise attached to the off side of the runner or cast integrally therewith, and serve for reducing the pressure on the off side by imparting a centrifugal force to the water on that side. This water-pressure can be accurately calculated. The adjacent head of the casing is provided with radial vanes D, extending inwardly toward the shaft of the runner from the inner ends of the vanes on the same, as shown in Figs. 2 and 3, and in the case that the vanes on the wheel extend to a circle of smaller diameter than the circumference from this circle to the circumference of the runner the vanes D on the casing serve to prevent the water from passing around with the runner. On this supposition—namely, that the water between the vanes on the casing remains at rest—an accurate calculation of the radial length of the vanes is possible.

By referring to the formulæ previously given it will be seen that the longitudinal thrust is a considerable factor in reducing the efficiency of the pump, especially in the case of high-speed and multiple-runner pumps. The arrangement of the vanes on the runner and casing disclosed in the present invention causes the pressures on the opposite sides of the pump to be more nearly equalized, and consequently results in the production of a pump of maximum efficiency.



It will be found that the pressure decreases from the outer to the inner ends of the outside vanes on the runner while remaining constant from the inner ends to the shaft, so that the desired result is thereby obtained.

By making the vanes longer or shorter in the radial direction of the runner the required reduction of pressure can be accurately obtained. By arranging the inner radial vanes  
10 D, Fig. 2, on the casing the water in the center is prevented from passing around with the runner.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

15 1. A centrifugal pump, consisting of a casing, a runner in said casing, an inlet at one side of said runner, vanes on said runner on the side opposite said inlet, and means on said casing coöperating with said vanes for preventing the passage of the water around with  
20 said runner.

2. A centrifugal pump, consisting of a casing, a runner in said casing, an inlet at one side of said wheel, vanes on the side of the  
25 casing opposite said inlet, and means on the runner coöperating with said vanes for pre-

venting the passage of water around said runner.

3. A centrifugal pump, consisting of a casing, a runner in said casing, an inlet at one side of said runner, vanes on said runner on the side opposite said inlet and vanes on said casing coöperating with the first-named vanes for preventing the passage of water around with said runner.

4. A centrifugal pump, consisting of a casing, and a runner provided with vanes at its off side or side opposite to the entrance of the water extending inwardly from points at or near its circumference, the head of the casing adjacent to the off side being also provided with radial vanes extending from the inner ends of the vanes on the runner toward the center of the head.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

KURT SCHOENE.

Witnesses:

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J. F. FITZSIMMONS.