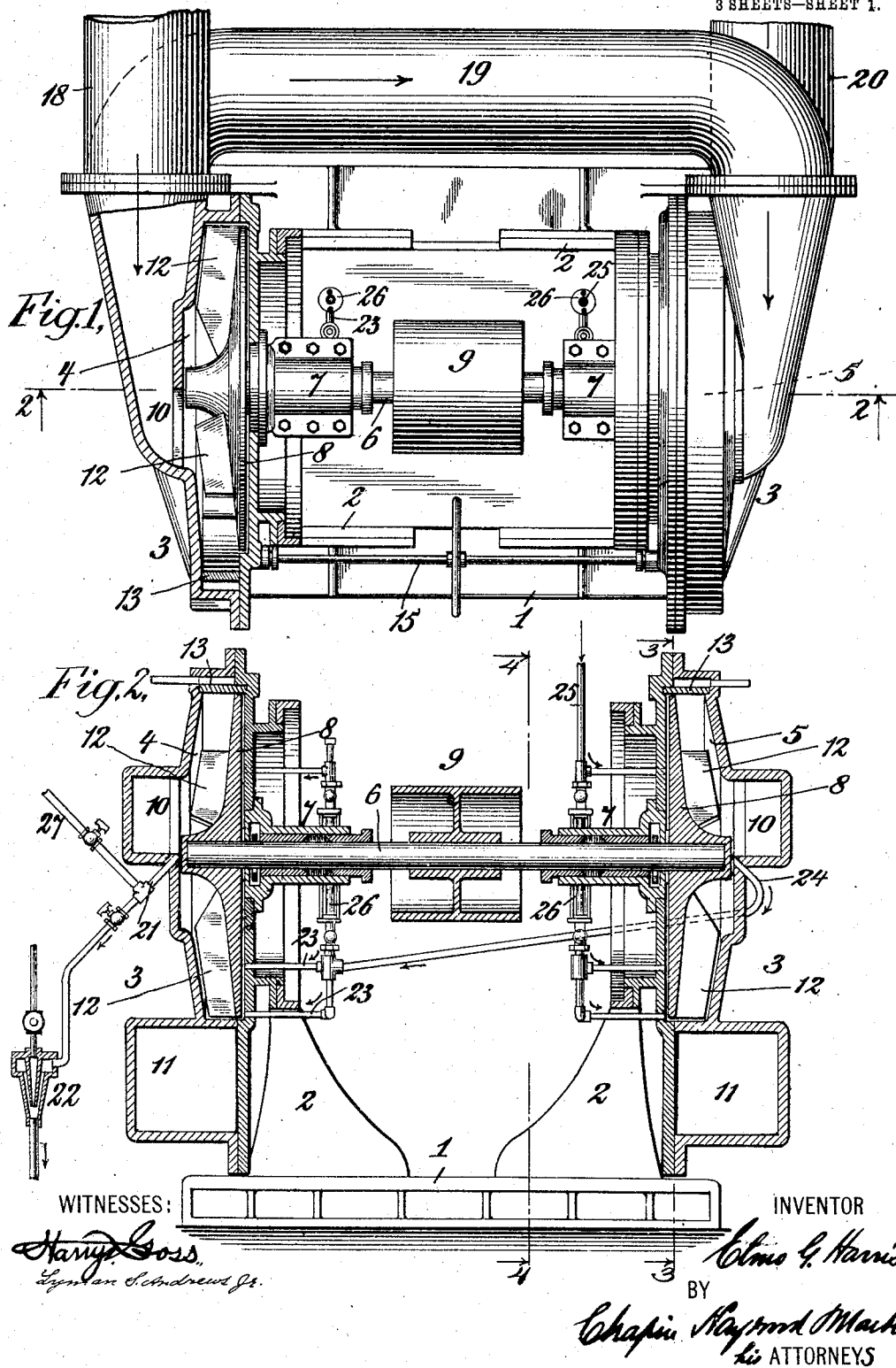


No. 790,683.

PATENTED MAY 23, 1905.

E. G. HARRIS.
CENTRIFUGAL PUMP.
APPLICATION FILED JUNE 9, 1904.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

Fig. 3,

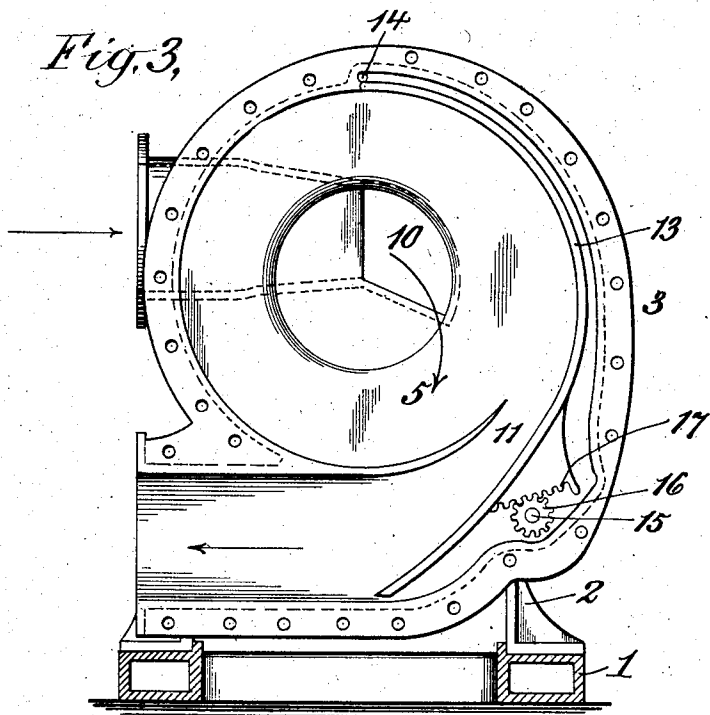
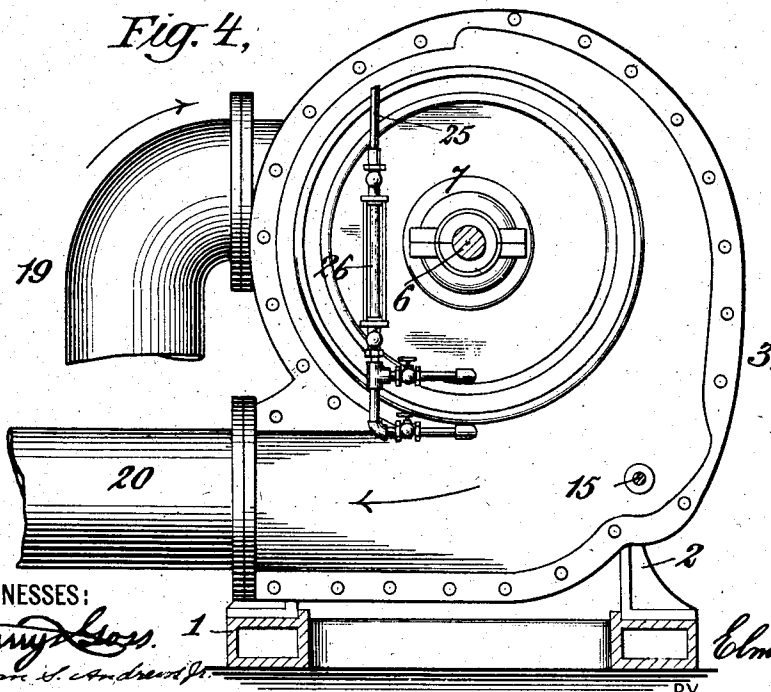


Fig. 4,



WITNESSES:

Harry L. ...
Lyman S. ...

INVENTOR

Edmo G. Harris

BY

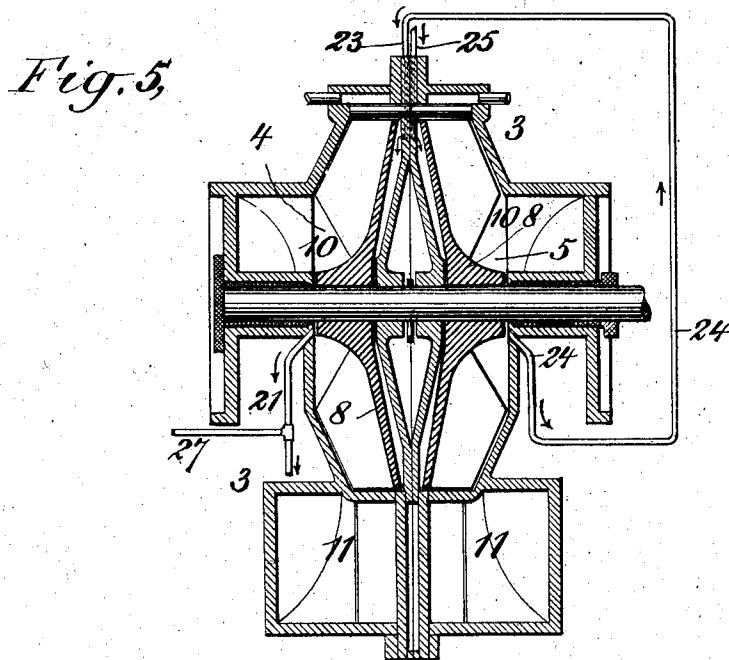
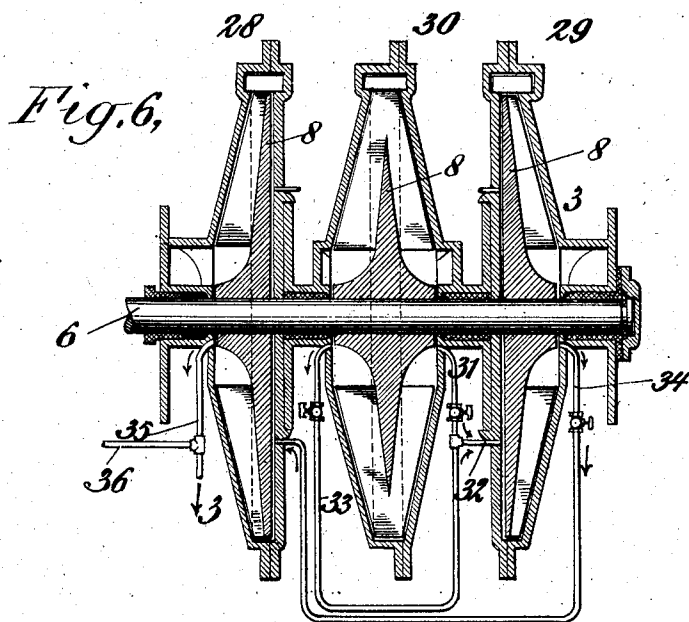
Chapin Raymond Munk
his ATTORNEYS

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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

ELMO G. HARRIS, OF ROLLA, MISSOURI.

CENTRIFUGAL PUMP.

SPECIFICATION forming part of Letters Patent No. 790,683, dated May 23, 1905.

Application filed June 9, 1904. Serial No. 211,766.

To all whom it may concern:

Be it known that I, ELMO G. HARRIS, a citizen of the United States of America, and a resident of Rolla, county of Phelps, State of Missouri, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to improvements in centrifugal pumps; and it consists, first, in certain improved means whereby air may be conveyed away from the front or intake side of the propeller-chambers; second, in means whereby the air so conveyed away from the front or intake side of the propeller-chambers may be admitted to the rear of the propeller-chambers of lower stages in the same pump; third, in a certain improved construction and relation of area of intake to the velocity of the propeller, whereby propellers having radial arms with plane faces may be employed; fourth, in certain improved means for priming pumps of this description, and, lastly, in certain novel details of construction and combination of parts, as will be hereinafter more fully pointed out.

In certain types of centrifugal pumps air carried in with the water or leaking into the pump from any source or admitted to the rear of the propeller for the purpose of clearing same from water and leaking past the periphery of the propeller is apt to creep back toward the center of the water or intake side of the propeller and accumulate there, impairing the efficiency of the pump.

One of the objects of my present invention is to convey away the air so collected in a simple, direct, and inexpensive manner.

In compound pumps having successive stages the pressure at the center of the water side of a propeller-disk of a higher stage is higher than the pressure at the rear of the disk of the next lower stage.

Another object of my invention, then, is to take advantage of this principle by connecting the propeller-chamber on the front or water side of a higher-stage propeller-chamber with the rear of a lower-stage propeller-chamber, so that air-conveyed away from

the front or water side of one chamber may be employed for clearing out the water at the rear of the propeller in another propeller-chamber.

Other objects of my invention are to avoid contention of currents in the pump, to simplify the construction of the runners, to simplify the priming of the pump when first starting up, and generally to simplify and improve the construction and operation of pumps of this character.

I will now proceed to describe apparatus embodying my invention and will then point out the novel features in claims.

In the drawings, Figure 1 is a top view, partially in central horizontal section, of a two-stage compound pump embodying my invention. Fig. 2 is a view in central vertical longitudinal section through the same. Fig. 3 is a view in vertical transverse section with the propeller removed, the plane of section being taken substantially upon the line 3 3 of Fig. 2. Fig. 4 is a view in vertical transverse section, the plane of section being taken substantially upon the line 4 4 of Fig. 2. Fig. 5 is a view in central vertical longitudinal section of a two-stage pump of somewhat different construction to that shown in the first four figures. Fig. 6 is a view in central vertical longitudinal section of a three-stage pump.

In the following description I will first refer to the form of pump illustrated in Figs. 1, 2, 3, and 4. This form of pump is a two-stage compound pump, in which the belt-wheel for driving the same is arranged between the two propeller-chambers, the said propeller-chambers being positively arranged with their propellers disposed vertically and arranged to rotate about a horizontal axis. Such an arrangement and construction results in a well-balanced pump as to weights and pressures. The casing comprises a bed-plate 1, supporting-standards 2, to which are secured members 3 3, inclosing propeller-chambers 4 and 5. 6 designates a horizontal shaft journaled in suitable bearings 7 7, carried by the members 3 3, and rotary propellers 8 8 are secured upon the said shaft 6 and are mounted in the said propeller-cham-

bers 4 and 5, respectively. A band-wheel 9 is also secured upon the shaft 6 and is arranged between the two propeller-chambers, as shown. The propeller-chambers are of the general type illustrated and claimed in a copending application, Serial No. 175,032, filed September 29, 1903. They are each provided with a tangential side inlet 10 and a peripheral discharge 11. In the present construction the side inlets 10 are arranged close to the center of the propeller-chambers and are so proportioned with relation to the speed at which the propeller is arranged to rotate as to admit water at substantially the same velocity at which the water rotates within the pump adjacent to the inlet. Such arrangement and construction will prevent contention of currents in the pump and permits the use of a propeller having radial blades with plane faces. As will be seen by reference to the drawings, the propeller-wheels comprise disk-like body portions and radial plane blades 12. The area of the discharge 11 may be varied so as to vary the amount of water discharged by the pump in a given time. For the purpose of so varying the area of discharge I have provided a swinging blade 13, pivoted at 14 and controlled by movements of a shaft 15 and gear-wheel 16, which meshes with a rack 17, carried by the said blade, whereby the blade may be moved in one direction or the other to enlarge or reduce the area of discharge. This blade forms no part of the present invention, but is separately claimed in the above-mentioned copending application.

In operation water enters through inlet-pipe 18, which connects with the inlet 10 of the first-stage propeller-chamber 4, through the propeller-chamber, and out through discharge 11 to cross-over pipe 19, which connects with the inlet 10 of the second-stage propeller-chamber 5. Thence the water passes through discharge 11 of said chamber and out through discharge-pipe 20. In this style of pump it is advantageous to supply air at the rear of the propeller-wheels and between them and the rear walls of the propeller-chambers, this being for the purpose of keeping the rear of the propeller-wheels clear of water, water passing away by centrifugal force and the air taking its place. This air may be forced or drawn in by any suitable means. I have found, however, that air in passing the peripheral edge of the propeller-wheels will sometimes work back toward the center at the front or intake side thereof. The radial motion of the water while in the pump is not sufficient to sweep out air that may be therein; but, on the contrary, centrifugal force will tend to cause the air to collect and remain about the center of rotation unless otherwise conducted away. Further, in a compound pump air passing out with the discharge from the first-stage

propeller-chamber will be delivered to the propeller-chamber of the second stage and will then tend to collect near the center, owing to centrifugal action. I therefore provide means for conducting air away from the propeller-chamber at the front or intake side of the same and preferably from a point as near the center as possible. In Fig. 2 will be seen a pipe 21, which communicates with the center of the front or intake side of the propeller-chamber 4. An ejector 22 may be connected to this pipe, so that the air may be drawn out by suction, or the pipe may extend into the sump or source of supply. By this means air collecting from whatsoever source at the center of the propeller-chamber on the front or intake side will be carried away. At the rear of the said propeller-chamber I have shown air-pipes 23, which connect with the interior of said propeller-chamber at the rear of the propeller therein. Air may be forced through these pipes for the purpose of supplying air to the rear of the propeller-wheel, as above described. In a compound pump of this type it will be understood that the pressure at the center of the intake or water side of the propeller-disk of a higher stage is greater than that at the rear of the propeller-disk of a lower stage. I therefore connect the pipe 24, which is arranged to convey air away from the center of the front or water side of the second-stage propeller-chamber 5, with the inlet air-pipes 23, leading to the rear of the propeller-chamber 4 of the lower stage. Air thus passing from the center of the front or intake side of the higher-stage propeller-chamber 5 will be used to supply air to the rear of the lower-stage propeller-chamber 4. Air may be forced through the inlet-pipe 25 at the rear of the second-stage propeller-chamber 5 by any suitable means, whereby air will be supplied between the rear of the propeller 8 and the rear wall of the said propeller-chamber 5. Suitable gage-glasses 26 may be employed for revealing the presence of air and its circulation.

For the purpose of priming the pump I have provided a branch pipe 27, connecting with the air-pipe 21. Any suitable exhaust or suction apparatus may be connected thereto for the purpose of drawing water up through the main supply-pipe into the casing to prime the pump. If an ejector 22 is employed for carrying away air during the normal operation of the pump, this may also be used, if desired, when first starting up for priming. The effect of the foregoing will be to prime the pump at the center, which is advantageous, as otherwise the rotation of the propeller before the casing had filled with water would be apt to cause the priming-pipe to take water before all the air was discharged.

In Fig. 5 a different form of pump is shown in which the two propeller-chambers are

placed close together. In such case the admission-pipe 25, leading to the rear of the second-stage propeller-chamber 5, is arranged at the periphery thereof, as is also the admission-pipe 23 for the rear of the first-stage propeller-chamber 4.

In Fig. 6 a three-stage pump is shown, reference character 28 designating the first stage portion of the pump, 29 the second stage, and 30 the third stage—that is to say, water first enters the portion 28 of the pump, then passes to the portion 29, thence to the portion 30, and thence to discharge. In this instance the third-stage pump is duplex, and hence there is no need for admitting air intentionally to the propeller-chamber. Air, however, will work in and when in the chamber will creep toward the center. From thence it may pass through pipes 31 and 33 to the rear of the propeller in the second-stage portion 29 of the pump through pipe 32, air collecting at the center of this portion of the pump passing out through pipe 34 to the rear of the propeller in the first-stage portion 28 of the pump, and air collecting in the center of the portion 28 will pass out through pipe 35, leading to suction means, as described for the other forms of pump. A branch pipe 36 is provided for priming the pump similar to the branch pipe 27, above referred to.

It will be obvious that the foregoing apparatus is capable of many and varied modifications within the spirit and scope of my invention, and, further, that certain parts may be employed in connection with other parts of different construction. Hence I do not desire to be limited only to the precise details of construction and combination of parts herein.

What I claim is—

1. In a centrifugal pump, the combination of a casing inclosing a propeller-chamber having a peripheral discharge and a lateral inlet, of a rotary propeller-wheel therein having a body portion and laterally-projecting blades on the front or intake side thereof, said casing provided with means for admitting air to the said propeller-chamber, at the rear of said propeller-wheel, and means for carrying air away from the front or intake side of the propeller-chamber, at the front of said propeller-wheel, said means connected with the said chamber at substantially the center thereof.

2. In a pump, the combination of a casing having a plurality of propeller-chambers and provided with means for conducting air from the front or intake side of one of said chambers to the rear of another of said chambers, and rotary propellers mounted in said chambers.

3. In a compound pump, the combination of a casing having a plurality of propeller-chambers, and provided with means for con-

ducting air from the front or intake side of a chamber of a higher stage to the rear of a chamber of a lower stage, and rotary propellers mounted in said chambers.

4. In a compound pump, the combination of a casing having a plurality of propeller-chambers, and provided with means for conducting air from the front or intake side of a chamber of a higher stage to the rear of the next successive chamber of a lower stage, and rotary propellers mounted in said chambers.

5. In a compound two-stage pump, the combination of a casing having two propeller-chambers, and provided with means for conducting air from the front or intake side of the second or higher stage propeller-chamber to the rear of the first or lower stage propeller-chamber, and rotary propellers mounted in said chambers.

6. In a pump, the combination with a casing having a propeller-chamber and a rotary propeller mounted therein, of means, connecting with the front or intake side of the said casing, and approximately at the center thereof, for exhausting air from the said casing for the purpose of priming the pump.

7. In a pump, the combination with a casing having a propeller-chamber provided with a tangential side inlet arranged near the center thereof and a peripheral discharge, of a propeller mounted in said propeller-chamber, the area of said inlet being so proportioned that the tangential velocity of the entering water will approximately equal the velocity of rotation of the water within the wheel adjacent to the inlet.

8. In a pump, the combination with a casing having a propeller-chamber provided with a tangential side inlet arranged near the center thereof and a peripheral discharge, of a propeller mounted in said propeller-chamber and provided with radial vanes having plane faces, the area of said inlet being so proportioned that the tangential velocity of the entering water will approximately equal the velocity of rotation of the water within the wheel adjacent to the inlet.

9. In a pump, the combination with a casing having a propeller-chamber provided with a tangential side inlet arranged near the center thereof and at one side of the axis of rotation of the propeller, and a peripheral discharge, of a propeller mounted in said propeller-chamber, the area of said inlet being so proportioned that the tangential velocity of the entering water will approximately equal the velocity of rotation of the water within the wheel adjacent to the inlet.

ELMO G. HARRIS.

Witnesses:

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W. J. McCAN.