T. R. HAYTON.

CENTRIFUGAL FORCE PUMP.

APPLICATION FILED OCT. 29, 1908.

973,782. Patented Oct. 25, 1910.

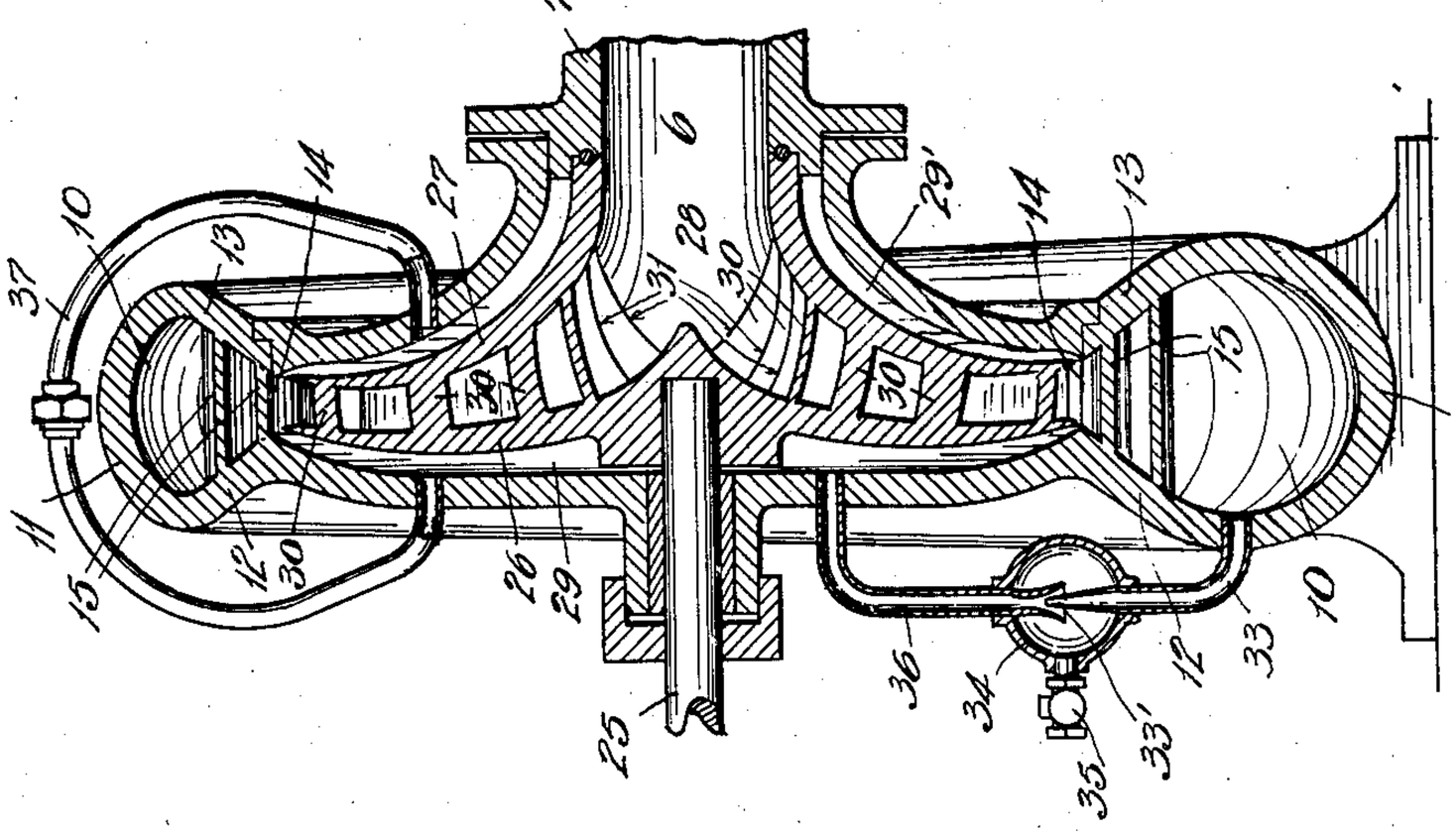

Fig. 1.

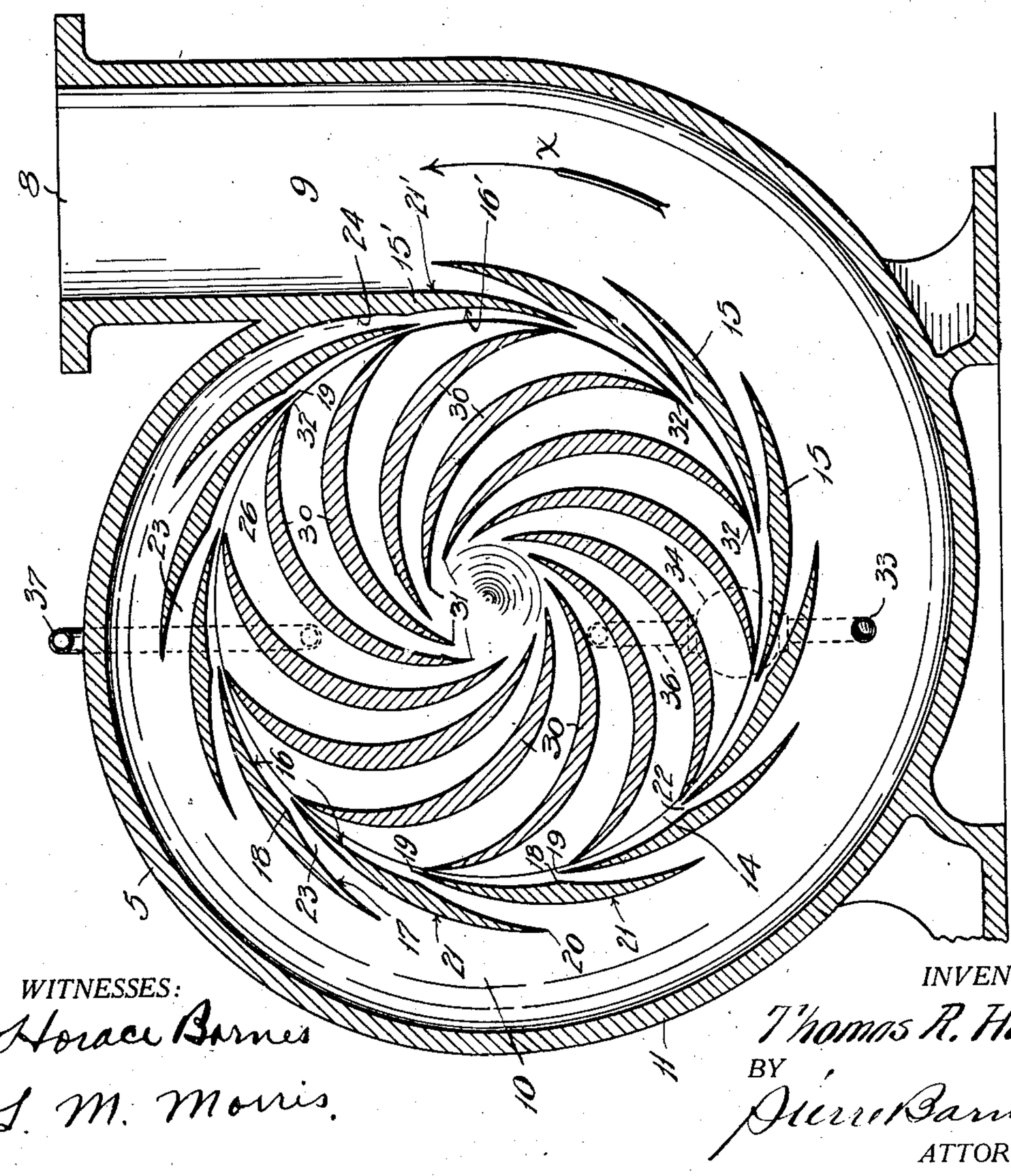

Fig. 2.

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CENTRIFUGAL FORCE-PUMP.

973,782. Specification of Letters Patent. Patented Oct. 25, 1910.

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To all whom it may concern:

Be it known that I, THOMAS R. HAYTON, a citizen of the United States, residing at Mount Vernon, in the county of Skagit and State of Washington, have invented certain new and useful Improvements in Centrifugal Force-Pumps, of which the following is a specification.

This invention relates to the centrifugal-type of pumps; and its principal object is to improve the construction and arrangement of the various operative parts thereof so as to render the same more efficient in the raising of water to a relatively high elevation.

Another object is the attainment of steadiness in operation with a delivery of water with slight variations as to quantity and rate of flow. And a still further object is the provision of devices for equalizing as much as possible the pressures imparted to the impelling wheel so that the unbalanced and endwise pressure thereupon may be reduced to a minimum.

With these ends in view the invention consists in the novel adaptation and combination of parts, as will now be particularly described with reference to the accompanying drawings, wherein—

Figure 1 is a transverse vertical section; and Fig. 2 is a longitudinal section of a pump constructed to embody the invention.

The reference numeral 5 designates the casing having an inlet opening 6 at one end, which is eccentric with respect to the casing and whereat the suction pipe 7 is connected. The delivery opening 8 of the casing is connected by a conduit 9 which is tangent to an annular passage 10 extending about the interior of the casing and of gradually decreasing size circumferentially of the casing chamber, as shown in Fig. 1. The outer peripheral wall 11 of said passage is desirably of a circular form in cross section and therefrom the walls 12 and 13 at the front and back, respectively, of the casing converge to a relatively narrow throat 14 which is concentric of the axis of the casing-opening 8. In proximity of the throat and between such converging walls is a plurality of stationary vanes 15 occupying a zone, so to speak, whose outer and inner circumferences are concentric of the aforesaid axis. Each of these vanes are formed upon their inner faces with two concave portions 16 and 17 which respectively extend from a medially disposed cusp 18 to sharp terminal inner and outer edges 19 and 20. The outside face 21 of each vane is desirably formed of a single arc. These vanes are symmetrically arranged such that the medial planes projected through the acute angles forming their inner and outer edges, 19 and 20, will be directed to be tangential, or nearly so, with relation to the circles in the circumferences of which these edges respectively terminate. Furthermore, the successive vanes are spaced to have the edges 19 positioned to be in proximity to the cusps 18 of the adjacent vanes, thus affording a contracted opening 22 between the inner edge 19 of each vane and the cusp 18 of the vane adjacent thereto, whence there extend conduits 23 of enlarging dimensions due to the curvature of the opposing surfaces 17 and 19 supplemented by the divergence of the casing walls 12 and 13.

One of the vanes, as 15′, see Fig. 1, may advantageously be formed to be coextensive with the partition wall 24 of the casing by having its surfaces 16′ and 21′ merge with the opposite surfaces of the partition.

Extending through the head of the casing is a power driven shaft 25 with its axis arranged to be in alinement with that of the opening 6 aforesaid. Mounted for rotation with this shaft is a wheel provided with a rear web 26 and a front web 27, the latter being centrally apertured, as at 28, to make communication between the space intermediate said webs and the casing opening 6. The wheel webs 26 and 27 are curved and spaced apart so that the distance therebetween diminishes from the axis toward the periphery whereat the separation of the webs is somewhat less than the throat opening 14 of the casing. There is likewise afforded between the webs of the wheels and the corresponding ends of the casing spaces 29 and 29′.

The wheel is provided between its webs with a plurality of concavo-convex blades 30 which extend from sharp inner ends 31 in proximity of the axis to sharp outer edges 32 at the periphery of the wheel and the various blades are symmetrically arranged and disposed so that their inner ends and the convex faces will be directed to correspond with the direction of their revolution, as indicated by the arrow X in Fig. 1, while the outer ends of the blades will be toward the rear.

Extending from the annular passage 10, where the water pressure is the greatest, is a pipe 33 which enters an air chamber 34 having a valve 35 of the non-return type, where atmospheric air is admitted to be transmitted through the pipe 36 to the space 29 within the casing and at a short distance from the wheel shaft by the nozzle 33′ extending into the mouth of the other pipe 36. The energy required to effect the pumping of the air into these air-packing spaces, as they may be deemed, is supplied from the ejection at a high momentum of the water through the pipes from the casing passage 10.

A by-pass pipe 37 is utilized to make communication between the spaces 29 and 29′ within the casing chamber and from points adjacent to the center thereof.

The operation of the invention is as follows: The wheel rotating at a relatively high velocity in the direction indicated by the arrow X in Fig. 1, revolves the blades 30 so that the advance inner edges of the same enter the supplied water with a scoop-like effect to cause the water to flow into the channels between the blades and through which it is caused to flow by reason of the centrifugal force while being influenced by the curvature of the blades to impel the water outwardly in a resultant tangential direction as it approaches the periphery of the wheel when the velocity of the water will nearly equal that of the wheel periphery. The water at such a velocity with a tendency to depart tangentially from its then circular course of travel impinges the vane surfaces 16 which subdivides the stream of water into a multiplicity of currents which escape at a high velocity through the orifices between the cusps 18 and the adjacent points 19 of the respective vanes. These orifices are made relatively small and beyond such contracted exits the conduits 23 enlarge progressively to their remote ends. Under such a provision, and as exemplified in a well established principle of hydromechanics (Bernoulle's Theorem) it is evident that the pressure derived in the discharge passage 10 will be increased proportionately to the lessening of its velocity and to an extent sufficient to balance a head due to a lift of a considerable height, and in fact, exceeding that attainable by any other pump with which I am familiar, excepting, perhaps, in certain makes of the well known reciprocating force pumps.

The function derived from the constructing of the vanes with the cusp and two concaved surfaces and the arrangement of such vanes with respect to each other is to transform the centrifugal motion of the driven water to a tangential motion supplemental to the latter force derived through the rotation of the wheel, so that when the motion is thus transformed, the speed of the water is equal to that of the wheel rim in passing through the restriction at the cusp. Beyond the cusp the area of the outlets increases for the purpose of retarding the flow to attain an increase in the pressure of the delivered water.

In operation, the pressure which obtains in the passage 10 affords energy to actuate the ejector pipes 33 and 36 to induce a flow of air into the casing chamber or space 29 accompanied by the impelling water, but through the differences in the specific weight of these fluids they are caused through centrifugal force generated by the rotary wheel to expel the water outwardly to escape through the contracted throat 14 where the pressure of water is so low as not to obstruct its delivery. The remaining air which is distributed by the pipe 37 to both sides of the wheel, offers little friction or viscous resistance to be overcome by the power which drives the pump.

Having described my invention, what I claim, is—

1. A centrifugal force pump comprising a rotary wheel provided throughout with closely arranged tangentially-disposed curved blades having each face thereof upon a single arc throughout and extending from a point in proximity to the axis of the wheel to the periphery thereof, said blades so disposed with respect to each other that the space between each pair of blades will gradually decrease in width in a direction toward the axis of the wheel, a casing inclosing said wheel and provided with an annular passage separated from the wheel by a contracted throat, and curved stationary vanes mounted in said throat and each having its inner face formed with two concaved portions each of equal length whereby a cusp is provided medially of the inner face of each of said stationary vanes, each of said stationary vanes having its outer face formed upon a single arc, each of said vanes so disposed that the inner end thereof will be positioned inwardly of and in close proximity to the cusp of one vane and its outer end projecting away from the outer face of another vane whereby the passage formed between two adjacent vanes will gradually decrease in width from its outer toward its inner end, said casing provided with an inlet and an outlet, said inlet opening into said wheel.

2. A centrifugal force pump comprising a rotary wheel provided throughout with closely arranged tangentially-disposed curved blades having each face thereof upon a single arc throughout and extending from a point in proximity to the axis of the wheel to the periphery thereof, said blades so disposed with respect to each other that the space between each pair of blades will

gradually decrease in width in a direction toward the axis of the wheel, a casing inclosing said wheel and provided with an annular passage separated from the wheel by a contracted throat, and curved stationary vanes mounted in said throat and each having its inner face formed with two concaved portions each of equal length whereby a cusp is provided medially of the inner face of each of said stationary vanes, each of said stationary vanes having its outer face formed upon a single arc, each of said vanes so disposed that the inner end thereof will be positioned inwardly of and in close proximity to the cusp of one vane and its outer end projecting away from the outer face of another vane whereby the passage formed between two adjacent vanes will gradually decrease in width from its outer toward its inner end, said casing provided with an inlet and an outlet, said inlet opening into said wheel, an air chamber exteriorly of said casing, a pipe extending in said chamber and communicating with said passage, and a pipe opening into said casing at a point inwardly of said throat and at the rear of the wheel and further extending in said chamber and overlapping said first mentioned pipe.

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