G. W. JOHNSTON.
SUBMERGED COMPRESSED AIR POWER PLANT.
APPLICATION FILED MAY 1, 1919.

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2 SHEETS-SHEET 1.

Fig. 1

Fig. 2

Fig. 3

Fig. 4.

Fig. 5.

Witness:

R. Hamilton

[Signature]
ATTORNEY
UNITED STATES PATENT OFFICE.

GEORGE W. JOHNSTON, OF ST. JOSEPH, MISSOURI.

SUBMERGED COMPRESSED-AIR POWER PLANT.

1,360,022.


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To all whom it may concern:

Be it known that I, George W. Johnston, a citizen of the United States, residing at St. Joseph, in the county of Buchanan, State of Missouri, have invented certain new and useful Improvements in Submerged Compressed-Air Power Plants, of which the following is a full and exact specification.

The present invention relates to submerged power plants, and aims to provide an improved construction of machine adapted to be actuated by the water movements or currents in either natural or artificial streams or other bodies of water, the primary object of the invention being to devise a machine designed to operate in water-submerged relation for air-compressing purposes, the compressed air being conducted away and stored for any desired use.

Accordingly, one of the objects of the invention is to provide an improved air-compressing apparatus arranged as a combined submerged water wheel and air-compressing unit incorporated as a part of the water wheel structure.

It is also sought to devise an improved water wheel construction having a novel type of air-compressing mechanism incorporated therein and operating in an efficient manner for taking air from the atmosphere, compressing it and forcing the compressed air to a suitable reservoir for storage.

A further object of the invention is the provision of a combined water wheel and air-compressing mechanism of the character described in which the air-compressing mechanism operates to compress the air in a step-up manner during its course through the machine.

It is also sought to provide an apparatus of the type indicated which is adapted for either stationary permanent installation in operative position in water-submerged relation, or for portable use in which the machine may be carried out from the shore to its submerged position and back again as often as is required for the machine.

With these general objects in view, the invention will now be described with reference to the accompanying drawings illustrating a practical construction for embodying the proposed improvements, after which the novel features therein will be set forth and particularly defined in the appended claims.

In the drawings:

Figure 1 is a side elevation, partly in section, showing a submerged power apparatus constructed in accordance with the present invention;

Fig. 2 is a plan view of the water wheel on a reduced scale;

Fig. 3 is an enlarged vertical sectional view showing the hub portion of the water wheel and the air compressing mechanism incorporated therein;

Fig. 4 is a section taken on the line 4—4 of Fig. 3;

Fig. 5 is a horizontal section (partly broken away) taken on the line 5—5 of Fig. 70;

and

Fig. 6 is a side elevation showing a portable construction of apparatus for embodying the improvements.

Referring to the said drawings in detail, these illustrate in Fig. 1 the arrangement of the apparatus in water-submerged relation, the line of the water surface being indicated by the numeral 8, and the bottom or bed of the water course by the numeral 10.

A foundation 12 is provided in the form of a frame or casting having an inner compartment 14 adapted to be filled with concrete material 16 through a pipe 18 from above the water surface and thus affording proper ballast for the foundation, this pipe 18 being conveniently detached from the foundation after said filling operation is completed. The foundation 12 is also formed with an open bottom compartment 20 having connected therewith a pipe 22 whereby a vacuum or suction action may be produced within said compartment by any suitable means attached to the upper end of said pipe 22, for the purpose of anchoring the foundation securely in position, after which the pipe 22 may be closed by means of a valve 24 located at any desired point. At any time that it may be desired to remove the apparatus after being thus anchored, this may be accomplished by first releasing the vacuum action in said compartment 20 and then applying hydraulic pressure through the pipe 22, in conjunction with any suitable type of hoisting means which may be employed for lifting out the apparatus.

Mounted on top of the foundation 12 is a combined water power wheel and air-compressing mechanism, the same compris-
ing a cylindrical housing 26 forming the hub portion of the wheel which is adapted to be filled with suitable lubricant through a filling passage 28 provided with a cap 29. (The lubricating mixture being omitted for clearness of illustration of the other parts), said housing being provided with a central cap piece 30 having a cable loop 32 for attachment to the hoisting means above referred to. The housing 26 is provided with a series of radially projecting propelling members each of which comprises a pair of folding blades 34 hinged upon an arm 36 and so arranged as to open under the force of the current. Forming the axis of the power wheel is a fixed casting 38 which is supported upon the upper end of the foundation 12 and held in position by means of a ring 40 threaded on to the lower end of the casting and secured by screws 42 to the foundation. The housing 26 is supported upon ball bearings retained in mating grooves in the ring 40 and a ring 46 secured by screws 48 to the bottom of said housing, a protecting band 50 being carried by the ring 46 and overlapping the upper margin of the ring 40. The casting 38 is formed with different sizes of radially arranged pump cylinders, the drawings showing a cylinder 52 provided with a pair of oppositely moving pistons 54, and two smaller cylinders 56, 58, of equal size and in alinement at right angles to the cylinder 52 and each provided with a piston 57. These cylinders are all provided with water-jackets 60 having a water connection 62 leading down through the foundation 12 and to any suitable source of water supply. An air inlet pipe 64 conducts air from above the water surface to an air receiving chamber 66 in the lower end of the casting 38, whence an inlet valve 68 admits air to the space between the pistons 54 in the cylinder 52, from which space an outlet valve 70 admits the air as forced out by said pistons 54 into a chamber 72 in the upper end of the casting 38, which is closed by a cap member 74. From the chamber 72 check valves 76 control communication with the upper ends of the cylinders 56 and 58, whence outlet valves 78 admit the air as forced out by the pistons 57 to the branches 80 of a discharge pipe 82 leading to any suitable form of compressed-air reservoir 84 provided with a pressure gage 86 and valve connections 88 whereby the compressed air may be conducted off for any desired applications. The cylinder pistons are operated by means of a rotating gear 90 having its hub portion 92 journaled about the lower end of the casting 38 and connected for rotation with the water wheel by means of the screws 48; meshing with the gear 90 is a pair of gear wheels 94 secured to the lower ends of crank shafts 96 mounted in the outer ends of the cylinder 92 and having the crank arms 98 of said shafts connected with the piston rods 100 of the pistons 54. Also meshing with the gear 90 is a pair of smaller gear wheels 102 secured to the lower ends of crank shafts 104 mounted in the outer ends of the cylinders 56, 58, and having the crank arms 106 of said shafts connected with the piston rods 108 of the pistons 57.

With the construction above described, the water wheel is adapted to be rotated by the action of the water current or movement, as will be readily understood, which results in the reciprocation of the pump pistons by means of the described gearing connections, whereby drawing the air into the space between the pistons 54 on the outward movement of the latter, and on the inward or approaching movement of said pistons the air is compressed and forced out past the valve 70 into the chamber 72; from there the air is drawn by the outward or separating movement of the pistons 57 into the cylinders 56 and 58, where it is further compressed by the inward or approaching movement of the pistons 57 and forced out past the valves 78 into the discharge pipe 82 and thence conducted to the storage reservoir. An efficient combined structure is thus obtained for utilizing the force of the water flow to operate the air compressing mechanism and maintaining a compressed-air power supply which may be devoted to any desired purpose.

In Fig. 6 I illustrate an arrangement wherein the power wheel may be removably mounted upon a foundation 12' which is set in fixed position at a proper depth in the water, an inclined trackway 110 being provided which leads from the shore over suitable supporting members 112 to the top of the foundation 12' for supporting a truck 114 which carries the power wheel and a pumping mechanism in horizontal position. A cable 116 is used for letting the track down the inclined trackway and the latter is provided with upward extensions 118 for assisting in holding the power wheel in place at the end of the trackway.

In Fig. 1 the propelling members of the wheel are illustrated as arranged in staggered relation, as to the radial positions of the upper and lower members of the series, this being for the purpose of lessening the likelihood of the movement of the wheel being stalled or blanketed by the folding of the propeller blades as sometimes occurs where the members are arranged exactly in a staggered relation.
pairs, as shown in Fig. 6; this relative radial arrangement of the propeller members may of course be varied to any desired extent.

It is thus apparent that I have provided a simple and efficient construction for carrying out the desired objects of the invention, and maintaining a practical and economical source of power supply at a minimum of cost. The apparatus may be set up and operated in any suitable body of water or stream where sufficient force due to water currents is available for driving the wheel, and the tidal movements of the sea may also be utilized for its operation. Where used in navigable streams, the apparatus has the advantage that the location chosen for locating the same may be such as to in no way interfere with the movement of vessels, inasmuch as the water currents are of course not confined to the course of the vessels.

While I have illustrated a practical form of construction for embodying the proposed improvements, I desire to reserve the right to make such formal changes or modifications as may fairly fall within the scope of the appended claims.

Having described the invention, what I claim and desire to secure by Letters-Patent is:

1. A submerged power plant apparatus comprising a water power wheel provided with propelling members adapted to be operated by the water current, and air-compressing means mounted within said wheel and comprising a plurality of pump cylinders having air inlet and outlet connection and provided with operating connections actuated by the movement of the wheel and acting independently and successively to compress the air in two stages as it passes through the apparatus.

2. A submerged power plant apparatus comprising a water power wheel provided with propelling members adapted to be operated by the water current, and air-compressing means mounted within said wheel and comprising a plurality of pump cylinders provided with operating connections actuated by the movement of the wheel, one of said cylinders acting to initially compress the air and the remaining cylinders being arranged to receive the initially compressed air and recompress and discharge said air at a higher pressure.

3. A submerged power plant apparatus comprising a water power wheel provided with propelling members adapted to be operated by the water current, and air-compressing means mounted within said wheel and comprising a plurality of pump cylinders arranged in radial relation to the axis of the wheel, a gear mounted coaxially with said wheel and rotating in unison therewith, and a series of gears mounted on fixed axes and meshing with said first gear, said series of gears being provided with operative connections with said pump cylinders.

4. A submerged power plant apparatus comprising a water power wheel provided with propelling members adapted to be operated by the water current, and air-compressing means mounted within said wheel and comprising a plurality of pump cylinders arranged radially about the axis of the wheel and provided with valved communications adapted to permit successive compression of the air by said cylinders, a gear mounted coaxially with said wheel and rotating in unison therewith, and a series of gears mounted on fixed axes and meshing with said first gear, said series of gears being provided with operative connections with said pump cylinders.

5. A submerged power plant apparatus comprising a water power wheel provided with propelling members adapted to be operated by the water current, and air-compressing means mounted within said wheel and comprising a plurality of water-jacketed cylinders having air inlet and outlet connection and provided with operating connections actuated by the movement of the wheel and acting independently and successively to compress the air in two stages as it passes through the apparatus.

6. A submerged power plant apparatus comprising a water power wheel provided with propelling members adapted to be operated by the water current, the hub portion of said wheel comprising a rotating housing adapted to contain a lubricating mixture, and air-compressing means comprising a plurality of pump cylinders inclosed by said housing and provided with operating gearings also inclosed by the housing and adapted to be actuated by the movement of said wheel.

7. A submerged power plant apparatus comprising a foundation adapted to be supported upon the bed of the water course and provided with an inclined trackway extending from said foundation to a point above the water surface, a water power wheel provided with a truck adapted to traverse said trackway and having a cable for trailing said truck into and out of position over said foundation, and air-compressing means mounted within said wheel and provided with operating connections actuated by the movement of the wheel.

In witness whereof I hereto affix my signature:

GEORGE W. JOHNSTON.