

C. E. BROCKHAUSEN.
 COMBINED LIQUID AND GAS TURBINE.
 APPLICATION FILED FEB. 28, 1907.

965,985.

Patented Aug. 2, 1910.

Fig. 1.

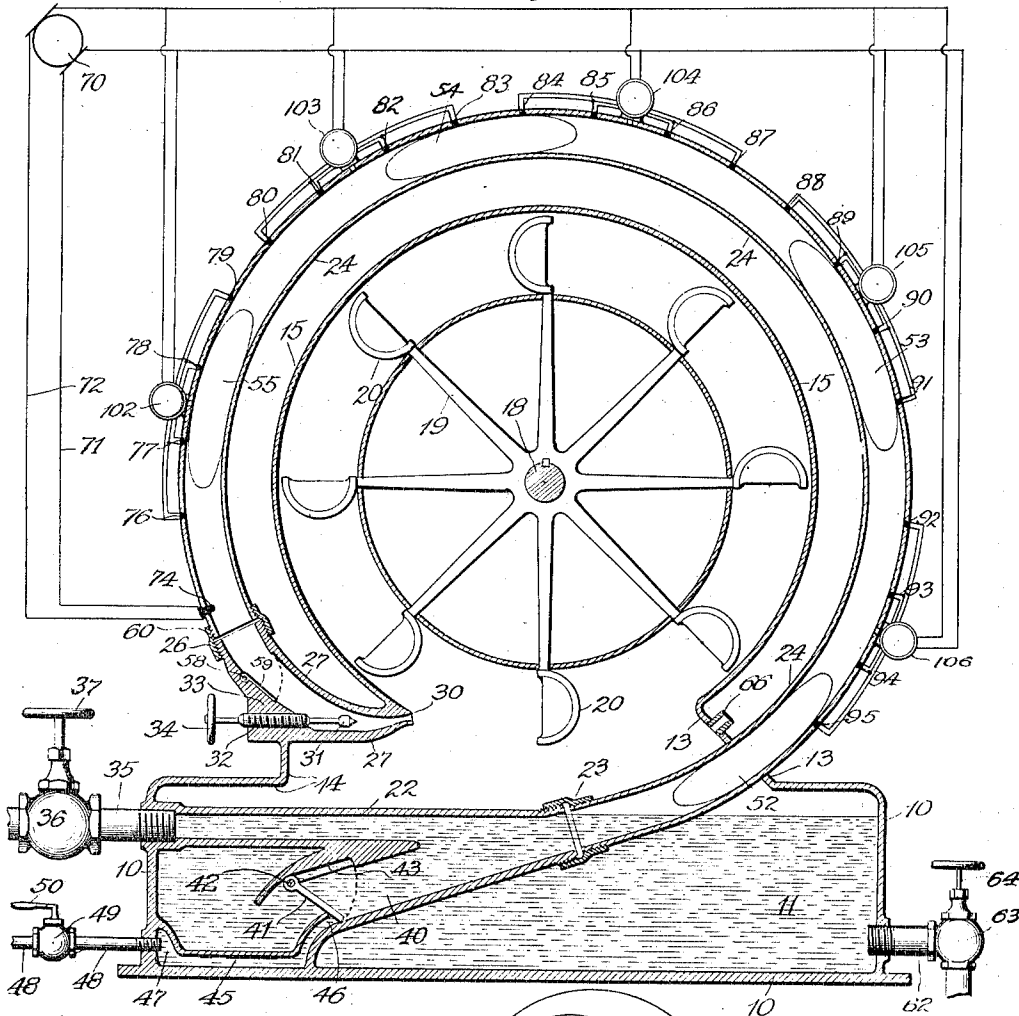
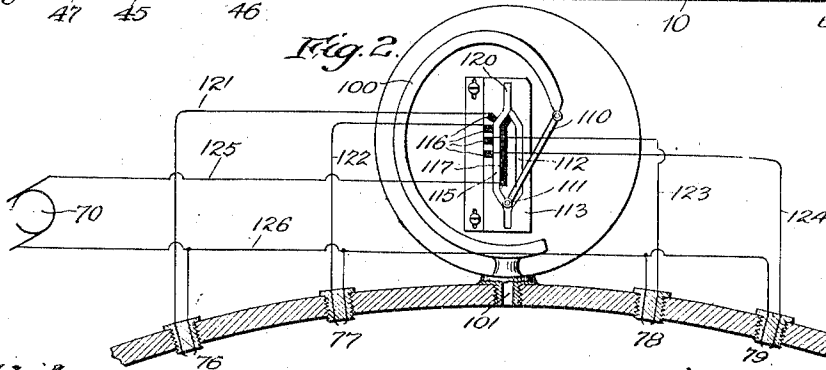


Fig. 2.



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CARL E. BROCKHAUSEN, OF CHICAGO, ILLINOIS.

COMBINED LIQUID AND GAS TURBINE.

965,985.

Specification of Letters Patent.

Patented Aug. 2, 1910.

Application filed February 26, 1907. Serial No. 359,477.

To all whom it may concern:

Be it known that I, CARL E. BROCKHAUSEN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Combined Liquid and Gas Turbines, of which the following is a specification.

The object of my invention is to construct a mechanism in which the explosive power of gas may be used in combination with water to generate power.

The object of my invention is to construct such a device which will be simple in construction and efficient in operation.

My invention consists in an impulse wheel such as is ordinarily used in water wheels of the best or Pelton type provided with a pipe leading thereto terminating in a nozzle adjacent to one of the buckets in combination with means for admitting bubbles of gas to the water, in combination with means for exploding said bubbles of gas within the water so that the propulsive force of the water discharged from the nozzle against the buckets is greater than it otherwise would be, the whole in combination with mechanism for compressing and firing the bubbles of gas in the pipe.

My invention also consists in details of construction which will be hereafter more fully described and claimed as the specification proceeds.

In the drawings Figure 1 is a central sectional detail view through the mechanism of my invention. Fig. 2 is a detail view of a Bourdon gage used for firing spark plugs along the discharge pipe showing the wiring for the same.

In constructing the preferred form of my invention I provide a hollow base casting 10 having a space therein adapted to contain a permanent supply of water 11. Rising from this base portion 10 and connected thereto by the walls 13 and 14 is a cylindrical upper casing 15 having a clear opening in its bottom connecting with the water space just described. In the center of this upper casing 15 is journaled a shaft 18 having spokes 19 on each of which is an impulse bucket 20 of the ordinary type used in any of the well known water wheels. Entering one side wall of the base portion 10 is a horizontal water pipe 22 connecting inside the device at 23 to the circular pipe 24 which passes through the wall 13 and

thence around the outside of the casing 15. The opposite end of this pipe 24 is connected at 26 to a tapering portion 27 terminating in the nozzle tip 30 in proper position with reference to the path of travel of the buckets 20 so that when water is discharged from this nozzle it strikes an adjacent bucket in the ordinary manner. The pipe 24 may be straight and any number of them may be used if desired. This nozzle 30 is regulated by means of a valve 31 screw threaded at 32 into a wall portion 33 of the nozzle wall 27. This valve 31 is operated by the hand wheel 34.

The outer end of the pipe 22 is connected by a pipe 35 to any source of water under pressure. This pipe 35 is adapted to be closed off by a valve 36 operated by a hand wheel 37 located at some point in its length.

The pipes 22 and 24 have entering them, within the water space 11, an angular pipe 40 adapted to be closed by a plate valve 41 pivotally mounted at 42, as shown, near the lower end of said pipe 40. This valve 41 is adapted to swing up into the pocket 43 provided for it. Running along the bottom of the base portion 10 is a passageway 45 having its forward end 46 entering the pipe 40 and adapted to be normally closed by the valve plate 41. The opposite or outer end 47 of the passageway 45 is connected to a gas pipe 48 controlled by a valve 49 operated by a handle 50. This gas pipe 48 is connected beyond the figure to a source of moderately compressed gas under a pulsating pressure so that when the valve 50 and the valve 41 are both opened gas is delivered in irregular quantities or bubbles from the opening 46 into the pipe 40 with the result that gas bubbles 52, 53, 54 and 55 travel into and around the pipe 24 heretofore described and ultimately pass out of the nozzle 30.

Adjacent to the nozzle end 30, preferably in the tapering pipe end 27, I mount pivotally at 58 a check valve 59 adapted when in the position of Fig. 1 to leave the passageway through the pipe 24 and nozzle 30 unobstructed and adapted when there is any back pressure or vacuum in said pipe to be lifted to a position against the shoulder 60 in which it closes the nozzle entrance to the pipe 24.

At some convenient place in the base portion 10 I place a discharge pipe 62 normally closed by a valve 63 controlled by a hand

valve 64 through which water may, when desired, be withdrawn from the interior of the base 10.

At some point in the lower part of the device and above the line of the water 11, I place a gas discharge pipe or vent 66 so that gas which has been exhausted by combustion in the manner to be hereafter described may pass out through this pipe 66 and escape into the open air.

Convenient to the mechanism heretofore described I place a magneto machine or other spark producing mechanism 70 which is adapted to be operated by any suitable means so as to produce a continuous supply of electric sparks across the points of spark plugs properly connected thereto. By means of the wire 71 and 72 I connect this magneto machine 70 to a spark plug 74 entering the pipe 24 adjacent to the angular nozzle 27—30 so that when any bubble of gas reaches this spark plug 74 it is exploded by means of the spark passing across the terminals of the spark plug in the ordinary manner. As it is highly desirable that gas bubbles in the pipe 24 shall be compressed before being fired I provide mechanism by means of which when the plug 74 fires a bubble of gas passing said plug and the reaction from said explosion compresses other bubbles of gas in the pipe 24 said compressed bubble or bubbles may also be successively fired. To do this I provide along the circumference of the pipe 24 and between the spark plug 74 and the wall 13 heretofore described quite a number of other spark plugs 76 to 95 inclusive. I divide these plugs 76 to 95 into groups of four and in the middle of each group I mount as is clearly illustrated in Fig. 2 a Bourdon tube 100. The various outside cases containing these tubes are designated by the numbers 102, 103, 104, 105 and 106. One end of each tube 100 is open to the tube 24 through the short screw threaded pipe 101. The opposite end of each Bourdon tube is connected by a link 110 to a roller 111 adapted to travel in a pathway 112 in a porcelain block 113 when the tube 100 is moved under the action of pressure of gas, water or the like in the tube 24 from the position of Fig. 2 toward a straight line position. This roller 111 is also adapted when the pressure in the tube 100 is released to travel back in a different passageway 115 over a plurality of contacts 116 each of which is as clearly shown in Fig. 2, connected by one of the wires 121, 122, 123 or 124, to one side of one of the four plugs to which the particular Bourdon tube is attached. On the opposite side of this groove or passageway 115 is another contact 117 connected as shown by the wire 125 to the magneto 70. The opposite sides of each of the spark plugs 65 connected to the particular Bourdon tube

are connected as shown by branch wires connecting with wire 126 to the opposite side of the magneto from that on which the block 117 is connected. The roller 111 is of such a size that as it passes down the groove 115 it makes electrical connection between one of the conducting plugs 116 and the plug 117 with the result that electricity from the magneto machine will pass through a contact 116 and contact 117 to a particular spark plug and thence back to the magneto machine during such time causing a spark to pass between the spark points of that particular plug. It will also be seen that this operation causes said sparks to take place in the four plugs connected to each Bourdon tube in regular order; as 76, 77, 78 and last 79.

In the operation of the mechanism of my invention assuming that both gas and water are shut off I first take hold of the handle 37 and open the valve which it controls to admit water under pressure to pipe 22. The valve 41 being closed as shown is held closely by the water thus coming in through the pipe 22 and the water is forced around the pipe 24 and out of the nozzle 30 against the buckets 20 and causes the wheel to rotate in the ordinary manner. If the valve 64 is wide open so that the water coming from the wheel can escape from the base 10 we have a plain water wheel of the ordinary type and nothing else. When the wheel has once started in the manner described I turn the handle 50 and open the gas valve 49 and admit gas to the pipe 45. This gas lifts the valve 41 sufficiently to allow some gas to enter the water within the pipe thereby causing the escaped gas to form bubbles in pipe 40 and pass up the pipe 24 mixing with the water as shown. The admitting of gas under pressure into pipe 24 tends to form alternate layers of gas and water around pipe 24 this action being similar to that in the apparatus known as the Pohle air lift (see Patents 659,491, 661,624). During this time the magneto 70 has been running, producing frequent sparks across the spark plug 74. When now the first gas bubble reaches the spark plug 74 the spark passing across it explodes this particular bubble of gas with the result that it tends to force the water adjacent to it in two directions. The water in front of it, between it and the nozzle 30, is driven out of the nozzle with great force against the adjacent bucket 20 thereby accelerating the rotation of the wheel 19. The opposite reaction of the exploding gas tends to compress the water which is behind it coming in through the tube 24. As water is practically noncompressible this reaction of the exploded gas bubble at 74 compresses the gas behind this point of explosion and at the same time tends to force the water or gas or the mixture of them into the vari-

ous Bourdon tubes 100 inside the cases 103 to 106 inclusive with the result that the rollers are moved out through the passageway 112 into the switching spaces 120. The brunt of this reaction pressure from the bubble opposite 74 is received by the second bubble 55 opposite gage 102 and largely absorbed by it so that in practice the first explosion opposite 74 only affects this one gage. Aside from this I gradually increase the pressure on which the gages 102 to 106 successively operate so that in practice only one Bourdon tube is operated by an explosion of gas taking place in front of a plug connected to the tube next toward the nozzle 30. As the force of the explosion of the first bubble of gas spends itself the roller 111 in gage 102 returns to normal position through the passageway 115 over the contacts 116 with the result that the plugs 76, 77, 78 and 79 adjacent to it are caused to spark within the pipe 24. Any bubble or bubbles of gas which are in contact with any of these particular sparking plugs are exploded with the result that practically all of the water in front of them is driven out through the nozzle 30 against the wheel with great force. The reaction of this explosion causes gage 103 to operate to send sparks through plugs 80, 81, 82 and 83 thereby firing bubbles in front of them and causing gage 104 to operate and so on through all the gages. As soon as gage 106 has fired its plugs all of the Bourdon tubes have returned to their normal position and spark plug 74 is the only one which continues to make sparks, the water coming in through the pipe 22 again flows around the pipe 24, gas is mixed with it as before and when the first bubble of gas reaches the plug 74 the operation is repeated. The complete evacuation of the tube 24 by the force of the gas and the refilling with the water the gas bubbles takes place in such a short time that the acceleration of the wheel 19 acquired by the explosions above described does not spend itself, before the pipe 24 is filled with water and the repetition of the operation is begun.

During the operation of my device described the products of combustion of the gas after they pass through the nozzle 30 escape from the machine into the open air through the pipe 66.

Other liquids than water may be used without departing from my invention and similarly different gases suitable to the different liquids may be used.

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

1. In mechanism of the class described the combination of an impulse wheel, mechanism by means of which the working fluid causes said wheel to rotate, means for admitting an explosive gas to said working

fluid before it operates upon the wheel, means for exploding a bubble of gas upon the working fluid about to operate upon the wheel, and mechanism for then successively exploding other bubbles of gas at different distances from the point where the working fluid operates upon the wheel.

2. In mechanism of the class described the combination of an impulse wheel, a nozzle in operative relation thereto, a pipe so connecting said nozzle to a source of working liquid that there is working liquid within the pipe, means for admitting bubbles of gas into the liquid in the pipe and mechanism for exploding bubbles of gas in said liquid at a point adjacent to the nozzle.

3. In mechanism of the class described the combination of an impulse wheel, a nozzle in operative relation thereto, a pipe so connecting said nozzle to a source of working liquid that there is working liquid within the pipe, means for admitting bubbles of gas into the liquid in the pipe, means for exploding a bubble of gas at a point adjacent to the nozzle and means set in motion by the explosion of said first bubble for successively exploding other bubbles of gas in said water at different distances from the nozzle.

4. In mechanism of the class described, the combination of an impulse wheel, a nozzle directed against the wheel, a pipe connecting said nozzle to a source of water under pressure, means for admitting a mixture of gas and water to said pipe, means for exploding a bubble of said gas at a point adjacent to said nozzle and means set in motion by the explosion of the first bubble for successively exploding other bubbles of gas at increasing distances from the nozzle.

5. In mechanism of the class described the combination of an impulse wheel, a nozzle directed against the wheel, means for conducting operating liquid to said nozzle, means for admitting liquid and a plurality of bubbles of gas to said conducting means, mechanism for exploding a bubble of gas at a point adjacent to the nozzle and means operated by the back pressure generated in the conducting means by the explosion of the first bubble for successively first compressing and then exploding other bubbles of gas in said water at increasing distances from the nozzle.

6. In mechanism of the class described the combination of a rotatable wheel having buckets a nozzle directed against the buckets on the wheel a pipe connecting said nozzle to a source of water under pressure means for admitting bubbles of gas to said water and mechanism for exploding said bubbles of gas at a point adjacent to said nozzle.

7. In mechanism of the class described the combination of a suitable casing a rotatable wheel therein buckets upon the wheel a nozzle directed against the buckets a pipe

for conducting water under pressure to said nozzle means for admitting gas to the water as it passes through said pipe means for exploding a bubble of gas in said pipe adjacent to said nozzle and means for successively exploding other bubbles of gas in said water at increasing distances from the nozzle.

8. In mechanism of the class described the combination of a suitable casing a rotatable wheel having buckets a nozzle directed toward the buckets, means to admit water to said nozzle, means for admitting gas under pressure to the water within said water admitting means, means for exploding bubbles of gas in said admitting means and means for readmitting water which has once passed through the nozzle to said water admitting means as and for the purposes described.

9. In mechanism of the class described in combination with a member for conducting a mixture of liquid and gas; a plurality of spark plugs along said member and mechanism electrically connected to said spark plugs normally inactive adapted to be operated by the mixture of liquid and gas within said conducting means when an undue change in pressure takes place therein to fire said spark plugs in a predetermined order.

10. In mechanism of the class described, in combination with mechanism for conducting a mixture of liquid and gas, a Bourdon tube accessible to the pressure in the mixture of liquid and gas within said conducting means, a plurality of spark plugs along said conducting means, means for conducting a current of electricity to said spark plugs, and mechanism connected to said Bourdon tube and to the wiring of said sparking plugs whereby an undue pressure in the conducting means causes said Bourdon tube to operate the spark plug connected thereto in a predetermined manner.

11. In mechanism of the class described the combination with a pipe for conducting liquid, a plurality of spark plugs entering said conducting means, a Bourdon tube having one end entering said conducting means, a source of electrical energy having one terminal connected to each of said spark plugs, and the other end connected to one terminal of a switch, means for connecting an independent adjacent terminal of the switch to

each spark plug, and a contact mechanism operated by the Bourdon tube adapted to leave the connection between the spark plugs and the source of electrical energy open while pressure is increasing in the mixing of the liquid and gas within the conducting means and adapted to successively connect each plug with said source of electrical energy as the previously increased pressure in the pipe begins to decrease with the result that said spark plugs are successively fired as described.

12. In mechanism of the class described the combination of an impulse wheel, a nozzle directed against the wheel, means for conducting operating liquid to said nozzle, means for admitting operating liquid and a plurality of bubbles of gas to said conducting means, a spark plug entering said conducting means adjacent to the nozzle, a plurality of other spark plugs along said conducting means farther away from the nozzle, means for continuously sending sparks across the first spark plug, and mechanism connected to the second spark plugs, normally inactive, adapted when set in operation by pressure of liquid within said conducting means generated by the explosion of a portion of gas fired by the first spark plug, to fire said second spark plugs in predetermined order.

13. In a machine of the class described the combination of an impulse wheel, a nozzle in operative relation thereto, a receptacle for working liquid which has previously passed through the nozzle into contact with the wheel, a pipe connecting said nozzle to the liquid within said receptacle, means for admitting bubbles of explosive gas under pressure into said pipe below the level of liquid in said receptacle so that they tend to carry liquid from said receptacle through the pipe to said nozzle, and means for exploding a bubble of gas in said mixture of gas and liquid at a point adjacent to the nozzle.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

CARL E. BROCKHAUSEN.

Witnesses:

DWIGHT B. CHEEVER,
C. J. CHRISTOFFEL.