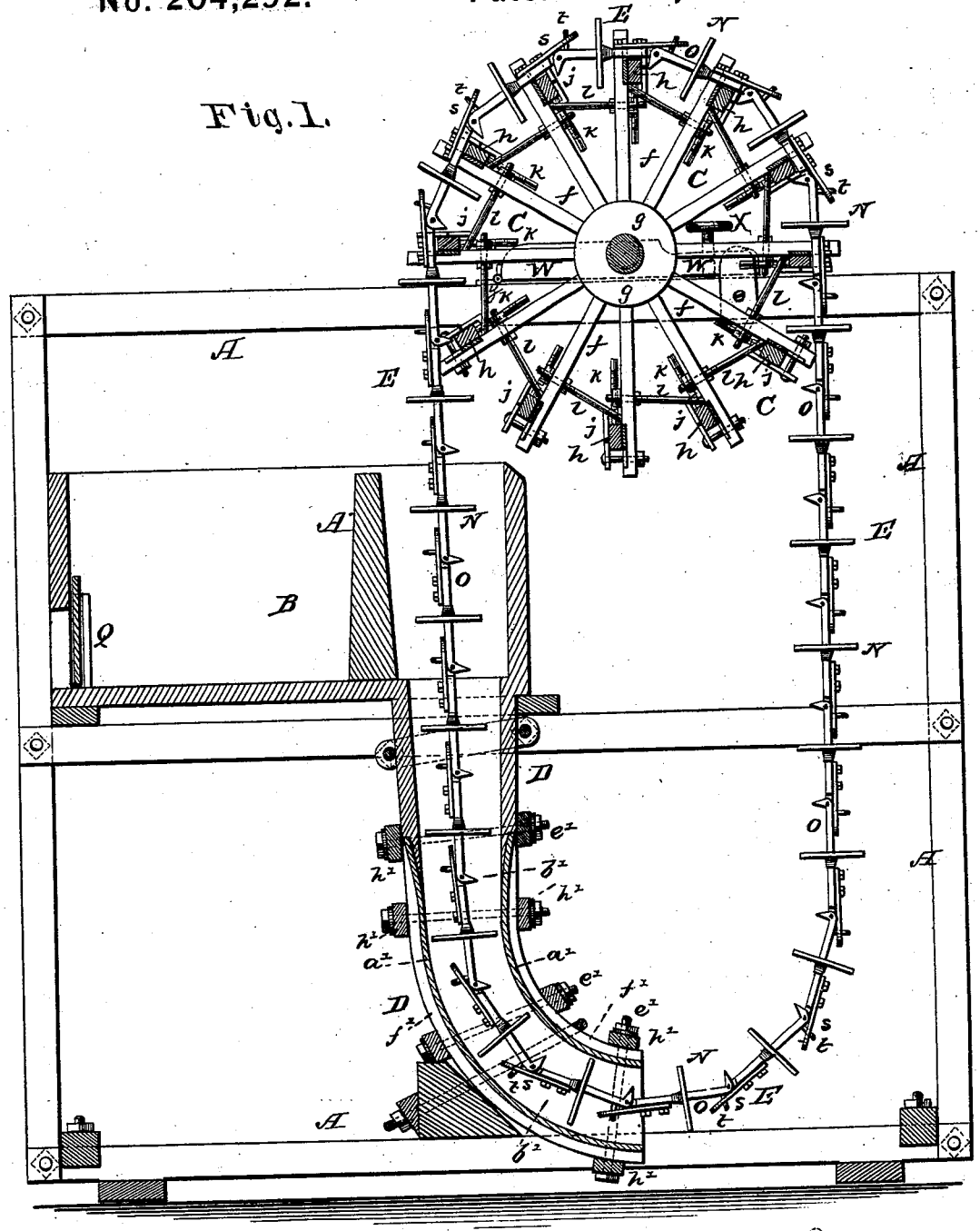
2 Sheets—Sheet 1.

W. S. CLAY
Water-Wheel.

No. 204,292. Patented May 28, 1878.

Fig. 1.



Witnesses:

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Frank N. Duffy

Inventor:

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2 Sheets—Sheet 2.

W. S. CLAY.

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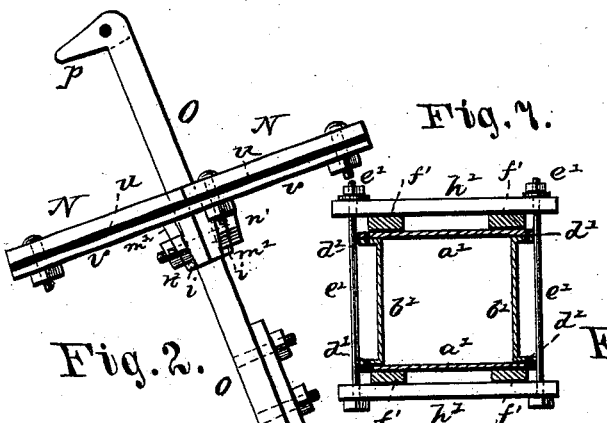


Fig. 2.

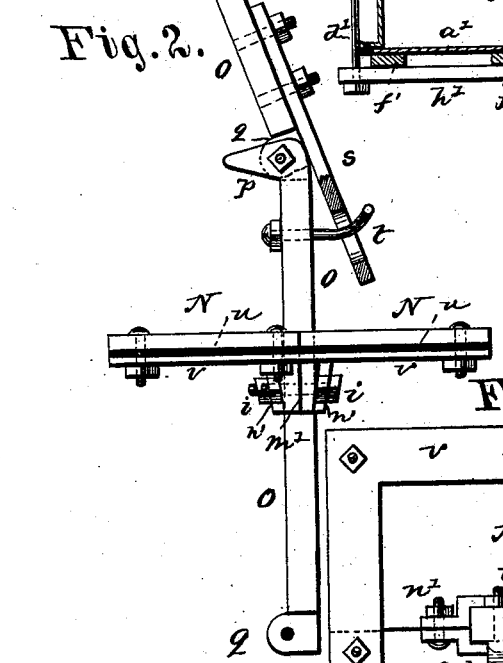


Fig. 3.

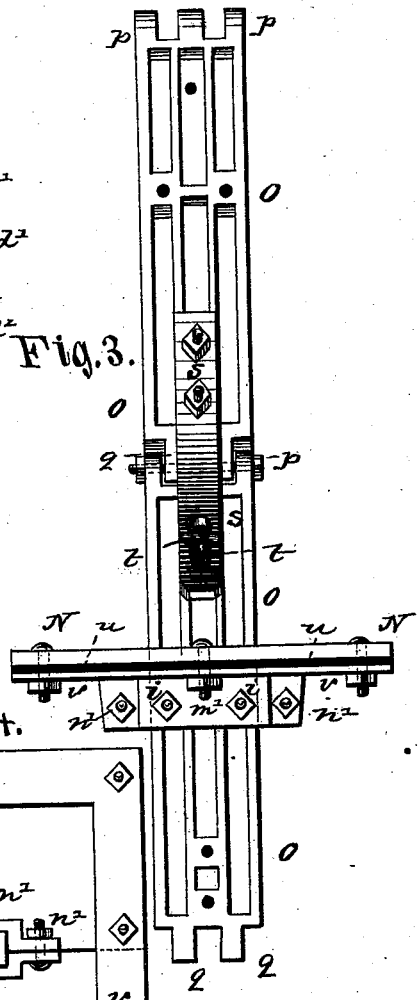


Fig. 4.

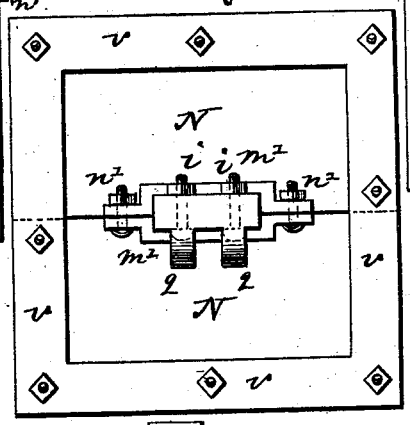


Fig. 5.

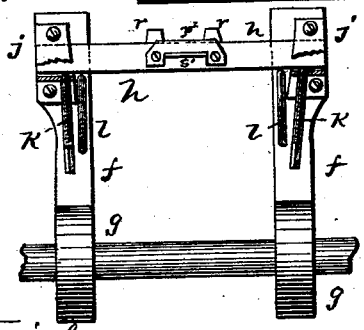
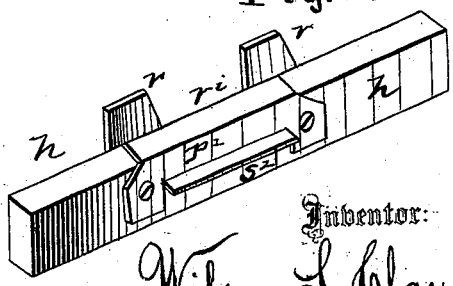


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILSON S. CLAY, OF VALPARAISO, NEBRASKA.

IMPROVEMENT IN WATER-WHEELS.

Specification forming part of Letters Patent No. **204,292**, dated May 28, 1878; application filed May 20, 1878.

To all whom it may concern:

Be it known that I, WILSON S. CLAY, of Valparaiso, in the county of Saunders and State of Nebraska, have invented certain new and useful Improvements in Water-Wheels; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention has for its object to improve the construction of water wheels or engines, whereby the entire weight and fall of the water can be utilized and the power increased.

To this end the invention consists, first, in the combination of an endless chain of buckets with a sprocket-wheel or other suitable guide-wheel and an upright water-tube, connected with the mill-race, the arrangement being such that the chain of buckets passes over the sprocket-wheel and down through the upright tube, so that the buckets shall receive the weight and force of water to move the chain while passing over the sprocket-wheel and give it a positive motion for the transmission of power.

It also consists in the means for joining the buckets to each other, so that the lower loop made by the endless chain shall preserve the same form and conform to the curvature of the tube, for the purpose of preventing the chain from binding in its passage through such tube.

It also consists in the construction of the sprocket-wheel, and in the means for its adjustment with respect to the chain of buckets.

It also consists in the construction of the bucket-connections, by which the chain is carried upon the wheel with a positive action.

It also consists in the combination of an abutment with the end of the race and the vertical water-tube, by which the flow of water in the race is prevented from displacing the buckets, and thereby obstructing their entrance to the tube.

My invention further consists in the construction and combination of parts, as will be hereinafter more fully set forth, and pointed out in the claims.

In the annexed drawings, to which reference is made, and which fully illustrate my invention, Figure 1 is a central vertical section of my improved water-wheel. Fig. 2 is an enlarged side view of two links of the chain with the buckets attached thereto. Fig. 3 is a front view, and Fig. 4 a bottom view, of the same. Fig. 5 shows a section of the sprocket-wheel, and Fig. 6 a detailed view of a part thereof. Fig. 7 is a cross-section of the water-tube.

A represents a suitable frame-work, of wood, supporting the end B of a mill-race, and furnishing bearings for the sprocket-wheel C.

D is a vertical tube or trunk, of metal or wood, secured at its upper end to the bottom of the race, into which it opens. At a point about midway from the top, more or less, the tube is curved to the lower end under the sprocket-wheel, as shown, and secured to the frame-work by bolts or other fastenings.

The curved portion of the tube D is preferably constructed of front and rear plates a' a', with side plates b' b' of proper form. The side plates b' b' are, along both edges, provided with outwardly-projecting flanges d', and these flanges bolted or riveted to the front and rear plates a'. The front and rear plates a' are strengthened by longitudinal ribs f', and the parts further secured by front and rear cross-bars h', the ends of which are connected by bolts and nuts e', whereby the tube is rendered firm and strong to resist all the pressure of the water from the inside.

E is the endless chain of buckets, passing over the sprocket-wheel and down through the upright tube, the sprocket-wheel being arranged upon the framing above the race, so that the chain shall fall in a vertical line directly into the tube. The form of the tube avoids the use of a lower wheel or pulley to guide the chain of buckets.

The wheel is composed of two series of radial arms, f, secured to the hubs g upon the main shaft, and connected together by cross-bars h h, which are held in place by the angular plates j j, bolted to the arms, as shown. Set-screws k pass through the angular portion of said plates, to bear against the inner edges of the cross-bars, for the purpose of regulating the position of the bars with respect to the

stops on the chain of buckets, and to tighten or loosen the chain, if necessary.

The arms of each series are also connected by adjusting-bolts *l*, by which the wheel is not only strengthened, but the arms adjusted a uniform distance apart to insure the action of the chain-stops against the cross-bars.

Each bucket is composed of two flat metal plates, N, which are mounted centrally and at right angles upon a link, O. The plates N are at their inner edges provided with cross-bars *m' m'*, made to fit around the link O, and said cross-bars are fastened together at their ends by bolts and nuts *i'*, and also fastened to the link by bolts and nuts *n'*, as shown.

Each link O is formed at one end with three stops, *p*, more or less, and corresponding eyes *q* at the other end, all being on the same side of the link. The stops of one link are pivoted to the eyes of the next adjoining link to form the chain, as shown. The links are of such length that the stops shall extend from one cross-bar of the sprocket-wheel to another, to prevent the chain from slipping upon the wheel.

The links are guided laterally as the wheel turns by fitting between upright arms *r r*, formed of a single plate, *r'*, secured to the side of each cross-bar. The edge of each cross-bar against which the links strike is lined with a plate, *p'*, which is turned over and fastened to the opposite side of the cross-bar from the plate *r'*, and on this side a portion of the plate *p'* is turned outward, forming a flange, *s'*, for the stops *p* to rest against.

Each link is also provided at one end with a projecting arm, *s*, and at the other end with a straight or curved bolt, *t*, both being on the side of the link opposite the eyes and stops.

The arm *s* of one link fits over the bolt *t* of that next adjoining, so as to play fully when the chain is moved. The object of this connection is to preserve the size and form of the loop formed by the pendent portion of the chain, so that it shall conform to the curvature of the water-tube, and thereby avoid the danger of binding or cramping the buckets therein.

When the chain is turning at the loop the bolts allow the links to swing outward only a certain distance, and then hold them rigidly in place, so that the loop cannot be made smaller —that is to say, so that the two sides of the chain can only be brought toward each other a certain distance. By adjusting the nuts upon the ends of the bolts *t*, the movement of the links on the bolts is regulated and the size of the loop adjusted to the curvature of the water-tube.

The buckets are of such size as to fit snugly within the tube, except at the upper portion of the latter, which is made a little larger to permit their free entrance, and to load the buckets when the chain is to be started.

The buckets are provided with a packing, *u*, held in place by plates *v;* and the whole chain is adjusted so that the buckets shall fit uniformly within the tube by raising or lowering the bearing-blocks W, which carry the journals of the sprocket-wheel shaft, and this is effected by means of the set-screws X, which pass downward through one end of the blocks and bear against the top of the frame, the other end of each block being hinged to the frame, as shown at *y*. Any other equivalent means may be employed, if desired.

The operation is as follows: The race-gate Q being opened, water is admitted to the buckets of the endless chain within the upright tube, causing them to travel downward, and thus turn the sprocket-wheel, from the shaft of which the power is transmitted in the usual manner. The stops *p*, by bearing against the metal-lined cross-bars *h* of the wheel, turn the latter without slipping, and therefore produce a positive action. An abutment, A', is placed securely within the race, just in front of the vertical tube, for the purpose of breaking the force of the water and directing it to the sides of the tube, so that its pressure shall not deflect the chain out of line with the mouth of the tube.

By my invention I am enabled to prevent waste of water, and at the same time utilize all its weight and pressure for moving the sprocket-wheel, and I therefore acquire more power for work than can be obtained by the use of the ordinary water-wheels.

I do not, of course, confine myself to the use of a sprocket-wheel, as I regard the invention broad enough to include any kind of wheel which will guide the chain with a positive movement and prevent it from slipping.

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

1. The combination of the sprocket-wheel C, made adjustable on the frame A by means substantially as described, with the endless chain of buckets and the upright water-tube, substantially as described, for the purpose specified.

2. The endless chain of buckets, composed of a series of links provided with buckets N and stops *p*, substantially as described.

3. The combination of the projecting plates *s* and bolts *t* with the bucket-links, for the purpose of preserving the slope of the pendent chain-loop, so that it shall conform to the curvature of the upright tube, substantially as described, for the purpose specified.

4. The sprocket-wheel constructed as described, with the cross-bars *h*, to receive the action of the stops *p* in the chain of buckets, substantially as described.

5. The cross-bars *h* of the sprocket-wheel, adapted, by means as described, for radial adjustment on the arms of the wheel to adjust the spaces between the stops *p* of the chain of buckets, substantially as described.

6. The radial arms of the sprocket-wheel, adapted for adjustment by means substantially as described, for the purpose specified.

7. The combination of the abutment A' with the end of the race B and the upright water-

tube, substantially as described, for the purpose specified.

8. The endless chain for the purposes herein described, consisting of buckets connected by links which have limited movement upon their pivots by means substantially as described.

9. The vertical water-tube, curved at its lower end and formed with an enlarged upper end, substantially as described, for the purpose specified.

10. The water-tube D, consisting of the front and rear plates a' a' and side plates b' b', having flanges d' d', in combination with the ribs f', cross-bars h', and nuts e', substantially as and for the purposes herein set forth.

11. The bucket consisting of the flat metal plates N N, provided with the cross-bars m' m', and fastened together and to the link O by bolts n' i', substantially as and for the purposes herein set forth.

12. In combination with the links O and the stops p thereon, the cross-bars h on the sprocket-wheel, the plates r', with arms r r, and the angular plate p', with flange s', substantially as and for the purposes herein set forth.

13. A water-wheel consisting of an endless chain of buckets, passing over an elevated guide-wheel and down through an upright tube or trunk, curved at its lower end to guide the chain, without a secondary or lower guide-wheel, substantially as described.

14. The combination of an endless chain of buckets, E, the sprocket-wheel C, the curved upright water-tube D, forming the lower guide for the chain of buckets, and the water-supply B, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

WILSON S. CLAY.

Witnesses:
WM. B. UPPERMAN,
FRANK GALT.