(No Model.)

J. KNAPP.

WATER WHEEL.

No. 347,810. Patented Aug. 24, 1886.

Fig. 1

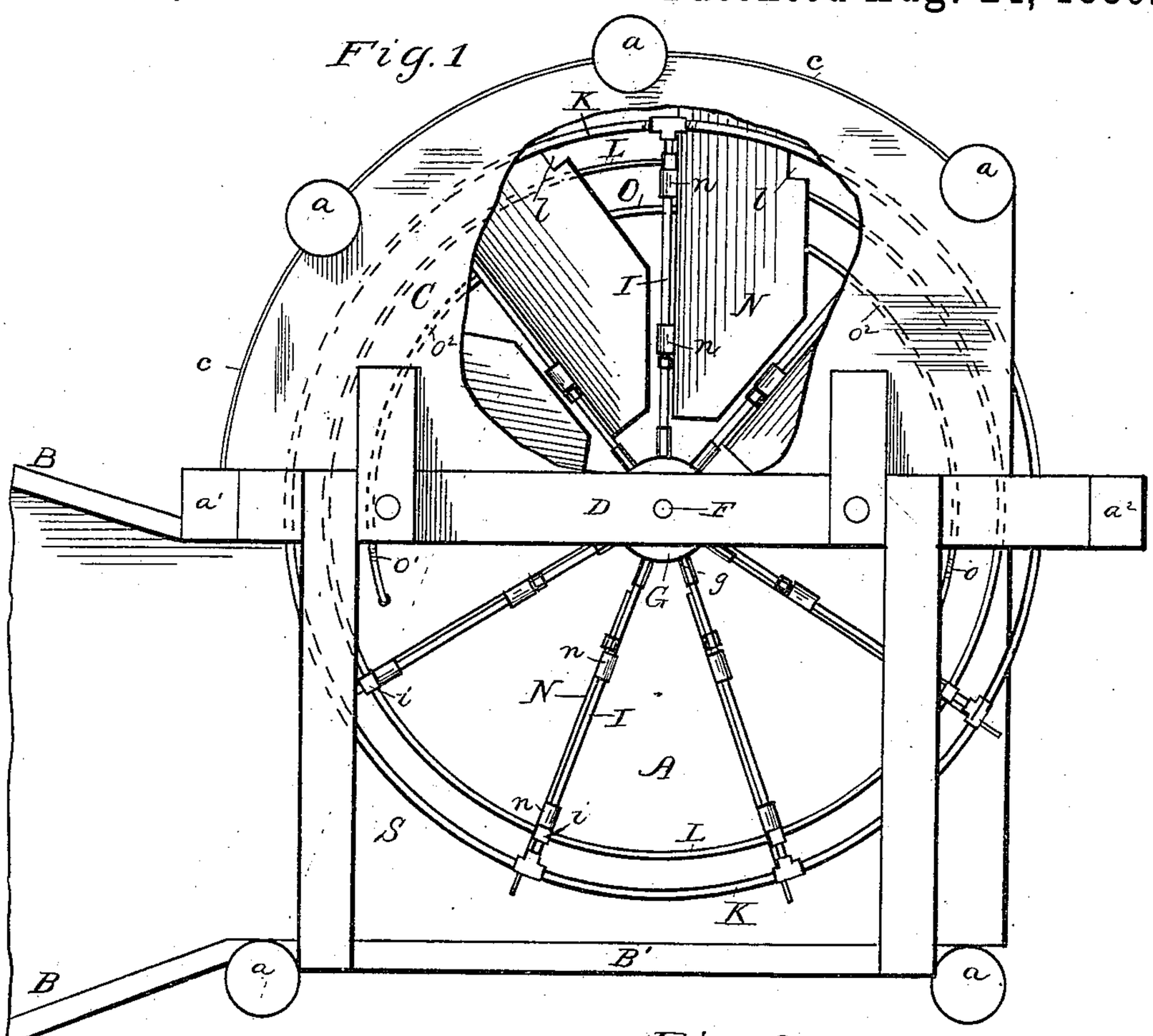
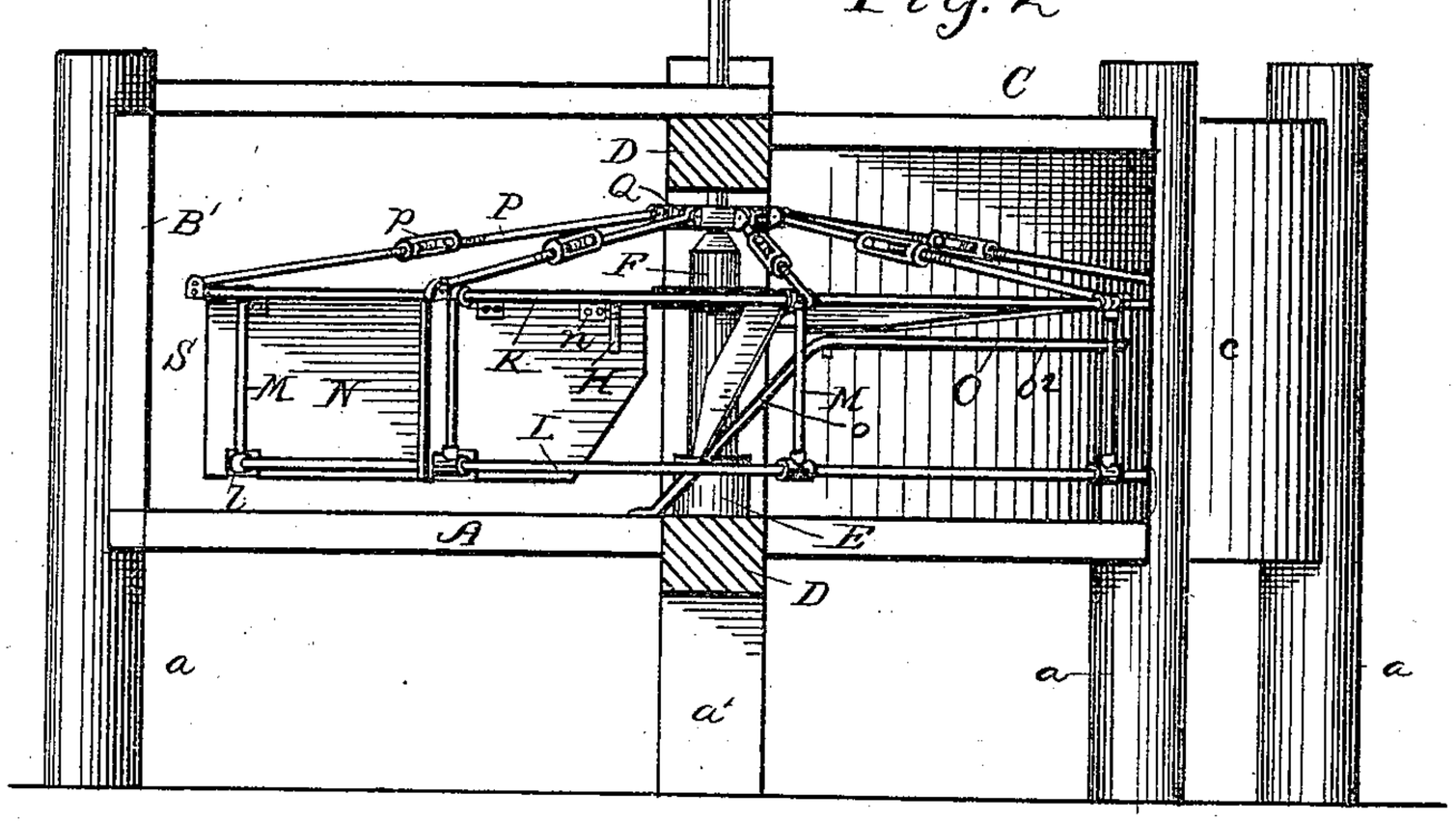


Fig. 2



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UNITED STATES PATENT OFFICE.

JOSEPH KNAPP, OF COLOMA, MICHIGAN.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 347,810, dated August 24, 1886.

Application filed January 30, 1886. Serial No. 190,358. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH KNAPP, a citizen of the United States, residing at Coloma, in the county of Berrien and State of Michigan, have invented certain new and useful Improvements in Water-Wheels, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of hydraulic motors known as "current-wheels," in which a horizontally-revolving water-wheel is submerged in the current of the stream, which acts against a portion of the blades thereof, those blades which are not being acted upon being, by means of a cam, guide-rail, or other device, so turned as to pass through the water edgewise.

Figure 1 is a top view of a water-wheel embodying my invention, together with the water-chute and casing in which it is mounted, parts of the latter being broken away. Fig. 2 is an end view looking upstream, parts being in section.

Wheels of the character of mine are frequently used in streams having a sandy or muddy bottom, which is liable to be shifted or washed out, and hence to render the operation of the wheel most effectual I mount it within a sort of casing or box, to which the water may be properly directed by wing-boards. To secure this box or casing in place I usually drive a series of piles, *a*, which insure a solid foundation.

A represents a platform, above which the water-wheel is mounted, it being placed upon the bottom of the stream or at such distance above as may be found most desirable.

B B are wing-boards, which may be employed or not, as found necessary. When used they operate to collect the water and direct it to the chute S and against the blades or paddles, which receive the power from the current and turn the wheel.

B′ is a wall, which forms one side of said chute, and in close proximity to which the outer ends of the working-blades travel. It is preferably straight and parallel with the direction of the natural current, in order that it shall offer as little resistance thereto as possible. That portion of the wheel carrying the idle-blades, which move in a reverse direction to the current, is partly inclosed by a casing or eddy-box, C, formed by the wall *c*, which is curved upon the upstream side and the side opposite the wall B′, so as to lie close to periphery of the wheel, but which is not continued upon the downstream side, that side being left open in order that there may be an eddy or backflow of the water in this eddy-box in order to assist in floating or carrying back the idle-paddles.

D D are beams parallel with the wall B′ and supported one above the other by the piles *a′* a^2, the pile *a′* being the one to which the upper end of the curved wall *c* is also attached.

The upper face of the lower beam D is preferably flush with the platform A, and supports a box, E, in which is mounted a bearing for the lower end of the shaft F which carries the water-wheel; this shaft being also supported in a bearing in the upper beam. The box E is packed with any suitable substance, and operates to keep sand and dirt from the bearing of the shaft.

G is a hub supported upon shaft F, between beams D D. It is preferably of cast metal and is provided with a series of outwardly-projecting tubes, *g*, into which are screwed or otherwise secured the inner ends of the spokes I of the wheel.

K is a ring of flat or round metal connecting the outer ends of spokes I, the connection being of any preferred kind, as by clips, screw-threads, &c.

In order to further strengthen the wheel, I employ another ring, L, which is of smaller size and mounted below the ring K. This ring L is supported by standards M, which connect it with the spokes I, there being T-sockets *i* carried by the spokes, into which the upper ends of the stands M are screwed, the lower ends being secured to the lower ring by clips or screw-threaded sockets.

N N are the blades or paddles, one being mounted upon each spoke by means of two or more eyes, hinges, or clips, *n*, which permit their swinging relatively to the spokes. The standards M operate as stops, against which the paddles swing when moving with the current to keep them in a perpendicular position in order to receive the full force of the water; but as soon as the paddles pass out of the direct current

they are free to swing back away from the standard and to pass edgewise through the water in the eddy-box.

In order to insure that the paddles shall turn as soon as they pass from the current and are no longer operative in driving the wheel, I mount a cam or guide rail, O, within the box C in the path of the paddles. It is inclined at its ends, as indicated at *o o'*. The downstream incline *o* is so placed that the lower edge of the paddle shall engage therewith as soon as it passes out of the current, and be guided by it to the horizontal part o^2, which is at such height that the paddles passing over it are turned into a substantially horizontal position, when they will be raised either entirely out of the water or else will pass through it edgewise, and thus offer very little resistance to the movement of the wheel. The upstream incline *o'* is so placed as to let the paddle fall, so that it will begin to catch the force of the current as soon as it passes the wall *c* into the chute S. Each paddle is cut away or notched on its lower edge at *l*, in order that it may straddle or fit over the lower ring, L, and fall down close to the platform A so as to receive the full force of the current. The inner lower edge of each paddle-blade is beveled or cut off obliquely, so that when folded up it shall not interfere with the blade next in the rear.

H H are downward-projecting standards or bearing-rods, carried by the spokes I between the standards M and the hub G, and adapted to receive the pressure of the inner end of the paddles when they are working and transmit it to the wheel. This supplemental bearing is necessary where the current is very strong and rapid, as without it there would be a tendency to split or break the paddle were it of wood, or to warp and twist it were it constructed of metal. Both standards H and M are arranged at some distance from the ends of the paddles, in order to give the most satisfactory support, and to overcome any tendency to warp in the middle by reason of the force of the current. In order to thus arrange the standards M, and at the same time to give them the necessary rigidity, it is desirable that the ring L, to which the lower ends of the standards are attached, should be arranged inside of the ring K. This necessitates the notching or cutting of the blades, as at *l*, if it is desired that they should move close to the bottom of the chute, which would be the case were there a small or insufficient supply of water.

In my construction the cam or guide rail O may be placed in a position between the hinges *n* of the paddles, in which position it operates to tip the blades most easily and without there being the same strain or twisting action upon the hinges of the paddles as there would be were the guide-rail arranged at the end of the paddles, outside the hinges. This is a very desirable feature, because when the current is swift and the wheel running rapidly there is quite a blow each time a paddle comes in contact with the rail, and it is desirable that these impacts or blows should be received at points upon the blades where they will cause the least wrenching and tearing action. Moreover, my construction enables the paddles to be supported against standards arranged at some distance from the ends, with the attending advantages hereinbefore referred to. These two very advantageous results are attained by bracing the standards M, which, being nearer the outer ends of the paddles, sustain the greatest amount of strain by the ring L only, they being unconnected with the hub except by the spokes I which pass over, and hence do not interfere with the guide-rail O.

I have shown the eddy-box as covered; but this is not necessary and may be omitted when desired.

The wheel may be entirely submerged in the water or arranged to have the blades dip more or less therein as the condition of the water or other circumstances may require, the wheel operating effectively whichever way it may be mounted. It is sometimes found more advantageous to incline the standards M, so that the lower edges of the paddles shall be thrown slightly upstream.

In Fig. 2 I have shown a series of brace-rods, P, which may be used when a wheel of very large size is employed. They are connected at their inner ends with the shaft F by means of a hub, Q, and at their outer ends with the rim K or the outer ends of spokes I, as may be most desirable. These brace-rods are preferably made in two pieces, as shown, and connected by a swivel-nut, *p*, thus permitting the proper tension to be maintained upon them.

The spokes I, standards H and M, rings K and L, and braces P are by preference constructed of gas pipe, which possesses the necessary strength and at the same time makes a comparatively light wheel.

It is practically necessary that all parts of the wheel should run true, especially when the wheel is large and the bottoms of the chute and eddy-box are boarded, because should any part drag upon the bottom the movements of the wheel will to that extent be retarded. This adjusting and truing of the wheel I accomplish by the swivel-nuts on the brace-rods P, whereby one part of the wheel may be raised and another part lowered, or the tension upon all parts changed to an equal degree.

What I claim is—

1. In a current water-wheel, the combination of the shaft F, the spokes projecting therefrom, the ring K, connecting the ends of the spokes, the horizontally-swinging paddles hinged to the spokes, the standards M, projecting downward from the spokes and adapted to support the paddles when in working position intermediately between their ends, the strengthening-ring L, of less size and situated

below ring K, and connecting the lower ends of the standards M, and the guide or cam rail O, arranged between ring L and the shaft F, substantially as set forth.

2. In a water-wheel, the combination, with the platform A, over which the current flows, of the shaft, the radiating spokes, the ring K, connecting the outer ends of the spokes, the swinging paddles, the standards M, arranged inside the ends of the paddles and adapted to support them when in working position, and the strengthening-ring L, of less diameter than the ring K, and connecting the lower ends of the standards M, the swinging paddles being cut away, as at *l*, on their lower edge in order to straddle or fit over the ring L, whereby they may travel in close proximity to the platform A, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH KNAPP.

Witnesses:

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D. C. JOHNSON.