T. Symonds,

Water Wheel,

No. 39,783, Patented Sept. 1, 1863.

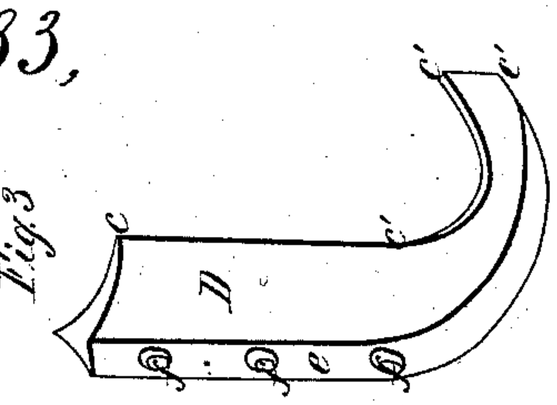

Fig. 3

Fig. 4

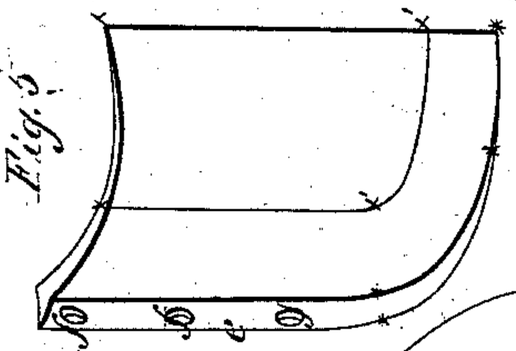

Fig. 5

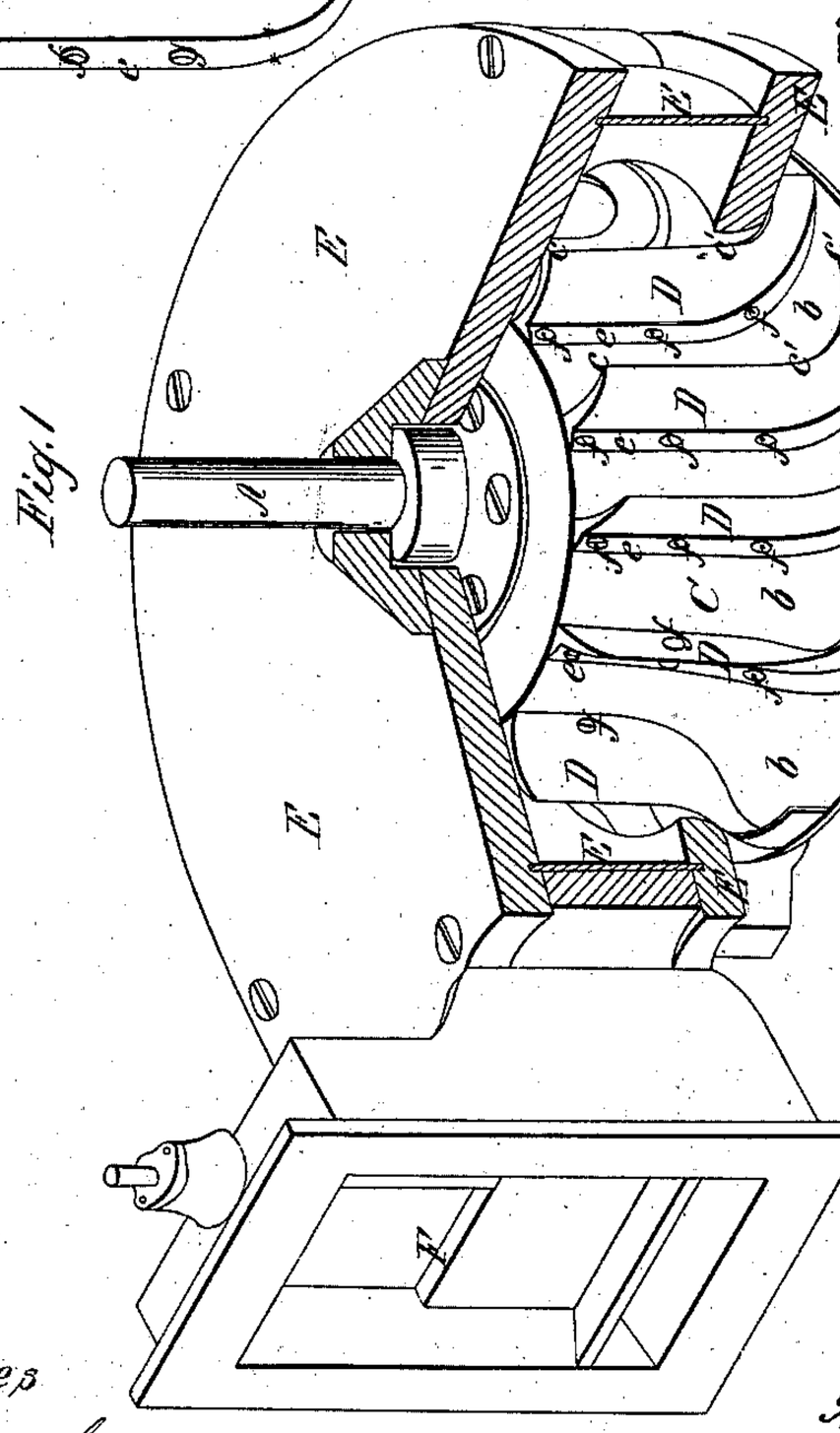

Fig. 1

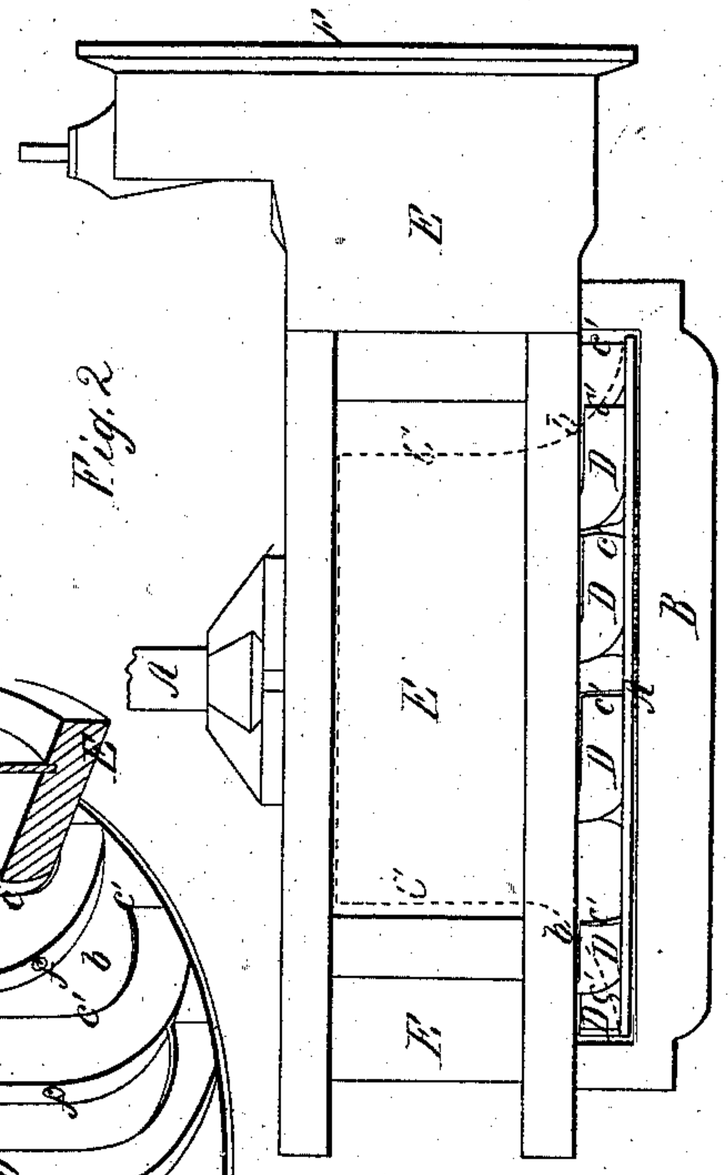

Fig. 2

Witnesses
Gustave Dietrich
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UNITED STATES PATENT OFFICE.

THOMAS SYMONDS, OF CUMBERLAND, MAINE, ASSIGNOR TO HIMSELF AND HOSEA KENDALL, OF SAME PLACE.

IMPROVEMENT IN WATER-WHEELS.

Specification forming part of Letters Patent No. **39,783**, dated September 1, 1863.

To all whom it may concern:

Be it known that I, THOMAS SYMONDS, of Cumberland, in the county of Cumberland and State of Maine, have invented a new and useful Improvement in Outer-Vent, Direct, and Reaction Water-Wheels; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective sectional view of my improved wheel. Fig. 2 is a side elevation of the same. Fig. 3 is a perspective view of one of the buckets from its rear surface. Fig. 4 is a similar view of the same from its front surface.

The same letters of reference in the figures refer to like parts.

The nature of my invention consists in buckets constructed with a deep direct-acting surface and with a shallow twisted and nearly horizontal reacting surface of great length, as hereinafter specified.

It consists, second, in the combination of such buckets with a hub of bell or trumpet mouth shaped circumference, and with a stationary scroll case of a depth just about equal to the depth of the direct-acting surface of the buckets, all as and for the purpose described.

To enable others skilled in the art to make and use my invention, I will proceed to describe the construction and operation of the same with reference to the drawings.

A is the shaft, B its step, C the hub, D the buckets, E the scroll-case or apron, and F the water-inlet gate, of the wheel. The hub C is of cylindrical form from its upper end to within a short distance of its lower end, where it enlarges circumferentially on a concave, forming a part of a flat scroll; or, in other words, the outline of the hub, as represented, is similar to that of the outer end of a trumpet or bell. This hub is fastened firmly upon the shaft A.

The buckets D, which are arranged upon the hub as represented, may be described as being formed out of a flanged segment-plate, or a plate, Fig. 5, which has the form of a depressed scroll. The lower edge of said plate being shaped to fit on a wind, the scroll concave portion *b* of the hub, as indicated by red line * *, and the outer edge, $c\,c'\,c^2$, of the bucket formed so as to present a straight vertical line and a curved horizontal line by cutting a piece out of the plate, Fig. 5, as indicated by the red line $\times\,\times'\,\times'$. The bucket thus shaped resembles very closely a boot-tree with its foot portion, from instep to toe, twisted round horizontally or bent thus on a curve or wind.

In manufacturing the buckets they may, of course, be cast, wrought, or otherwise produced on a pattern of the described shape.

By examining the drawings, it will be seen that the flange *e* of the buckets, by which they (the buckets) are firmly bolted to the hub, as at *f f*, affords a firm back support to them; also, that the concave form of the deep vertical portion of the buckets admits of strong bolts *f'* being introduced on the working-surface for the purpose of further fastening the buckets to the hub.

The buckets, from top to instep, are covered and inclosed by the stationary scroll-case or apron E, and thus deep water-tight water-channels, which are vertical, are formed for the reception of the direct-acting water; but below, or from the instep to the toe or discharging end, the curved or nearly horizontal portions of the buckets are not inclosed, they being on a gradually-increasing circumferential surface which is overhung by the bottom board of the scroll-case or apron, so as to cover in water-tight the open tops of the channels formed by the said curved horizontal portions of the buckets. Thus a free discharge of reacting water is secured, the reacting and direct-acting waters not interfering with one another, inasmuch as the latter is inclosed, and the former, by reason of the gradual enlargement of the circumferential surface of the hub, having due compensation for its increased velocity acquired in its change from a horizontal to a vertical course.

With my arrangement the wheel first takes its water direct, and then the reacting force thereof, the reaction being the quickest, owing to the water acquiring increased velocity in its descent. This increase in velocity is accommodated by the gradually-enlarged circumferential surface of the tub. Thus the pressure, as nearly as can be ascertained, is equably diffused over the whole surface or face

of the buckets. The scroll-case or apron being stationary, the wheel runs much stronger than it would with an apron which is carried round with the buckets, because the water, acting laterally against a fixed surface, derives therefrom a support upon which to impinge while transferring its force to the buckets. The construction and arrangement of the buckets also allows the wheel to run from eight to ten inches lower in water (back or dead) than any other existing wheel with which I am familiar, for the reason that there is so small a surface for the backwater to obstruct, and that small surface, the foot of the bucket, is always running away from the backwater, so that it cannot get a hold upon it.

In testing my wheel with others of equal head and fall, I find it is not less than ten per cent. stronger, and that with a low head of water it will run where all others that I am familiar with stand still. This is due to the great depth of the vertical or direct-acting part of the buckets and the shallow depth but great length of the reacting part of the buckets.

I have tried buckets similar to Leffel's patent of 1845, and many other similar forms, but find that to get the greatest reacting power the exhaust tube or apertures must be carried out horizontally, or as nearly so as practicable, and to as great a length as possible without creating dead-water.

I think in the plan shown and described I have attained the limit in proportion, very nearly.

The great advantage of my construction and arrangement will be readily ascertained by experimenting as follows: Cut from the buckets the curved or reacting part down and outwardly from the instep or inner diameter of the still apron or scroll-case, and it will be found that the power of the wheel is lessened one-half. Drop the buckets after the plan shown in Leffel's patent of 1845, and it is lessened one-third, or it ceases to run in dead-water—that is, with the reacting part of the buckets submerged—because Leffel's wheel does not work the full power of the water, but allows it to fall dead and useless.

I do not claim anything that is shown in my wheel which is embraced in the water-wheels patented to A. B. Beckwith, July 2, 1842, and to Wilbur M. Davis, June 24, 1856; but

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The buckets D, constructed in the form herein described, for the purpose set forth.

2. The combination and arrangement of the buckets D, gradually enlarging hub C, and stationary scroll-case or apron E, the whole constructed and operating in the manner and for the purpose specified.

Witnesses: THOMAS SYMONDS.
WM. H. WOOD,
CHANDLER RACKLEFF.