(No Model.)

2 Sheets—Sheet 1.

W. W. TYLER.

WATER WHEEL.

No. 480,753.

Patented Aug. 16, 1892.

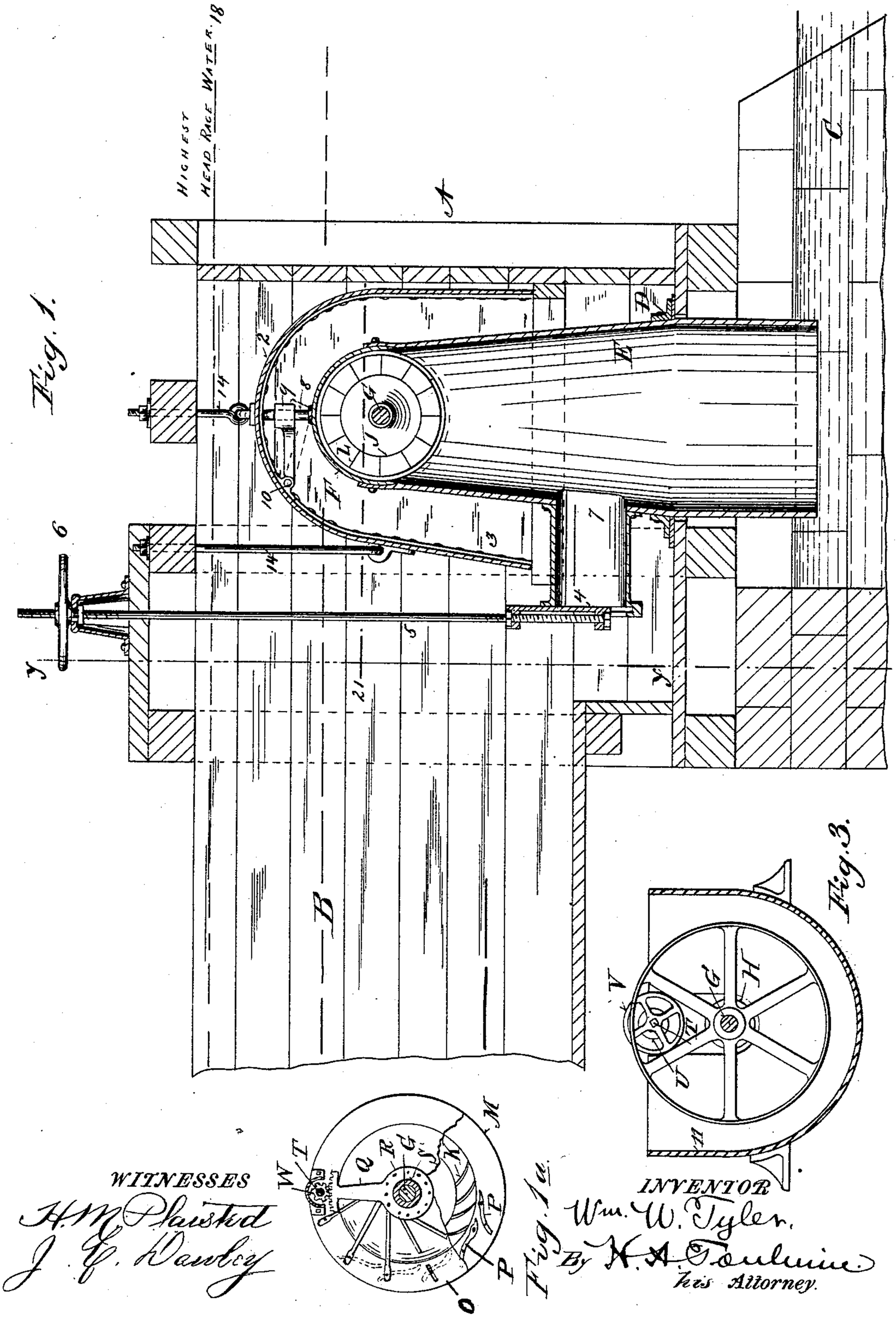

Fig. 1.

Fig. 3.

Fig. 1a.

WITNESSES

H. M. Plaisted

J. E. Dawley

INVENTOR

Wm. W. Tyler.

By H. A. Toulmin.

his Attorney.

(No Model.) 2 Sheets—Sheet 2.

W. W. TYLER.

WATER WHEEL.

No. 480,753. Patented Aug. 16, 1892.

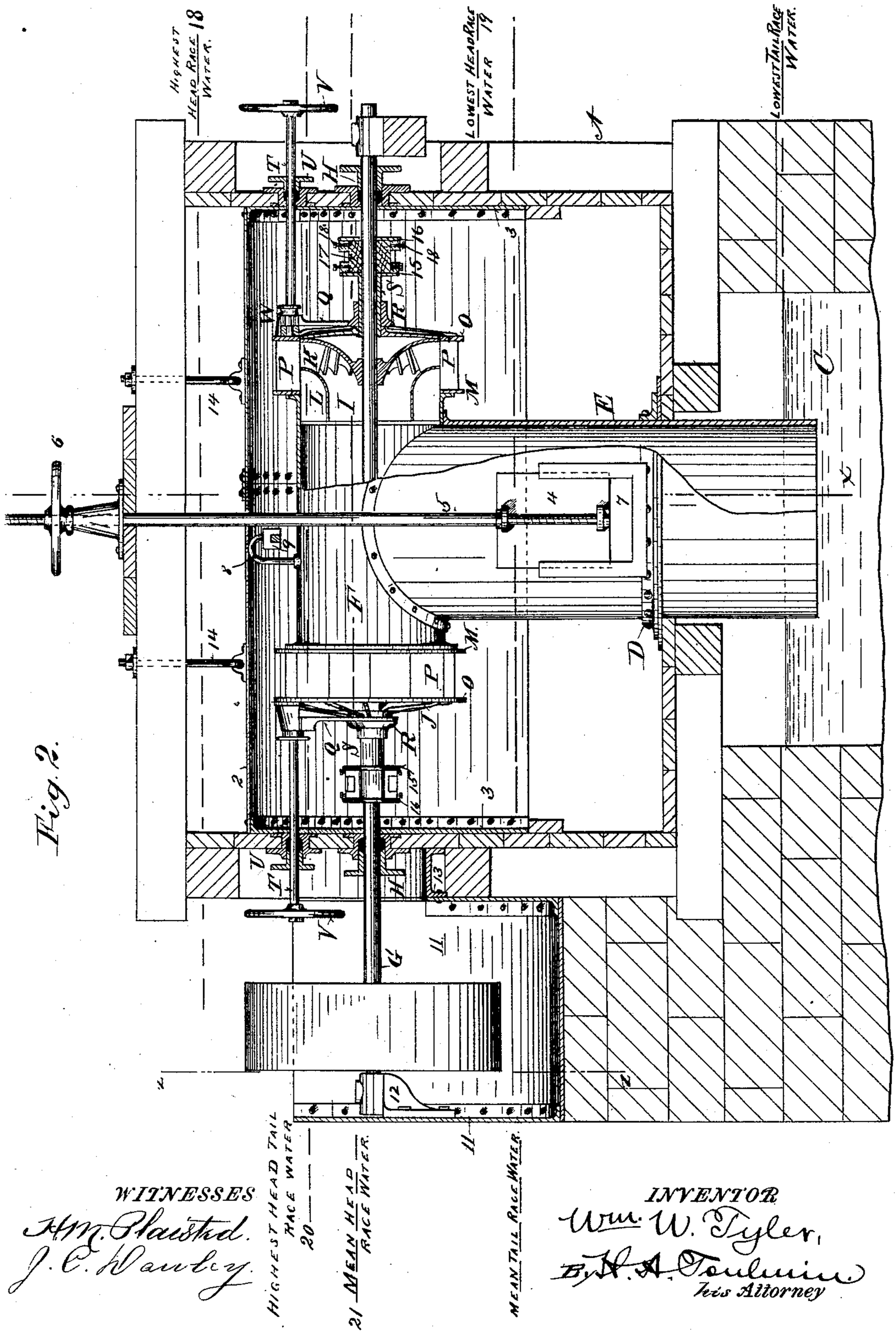

Fig. 2.

WITNESSES
H. M. Plaisted.
J. C. Hawley.

INVENTOR
Wm. W. Tyler,
By H. A. Toulmin
his Attorney

UNITED STATES PATENT OFFICE.

WILLIAM W. TYLER, OF SPRINGFIELD, OHIO, ASSIGNOR TO THE JAMES LEFFEL & COMPANY, OF SAME PLACE.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 480,753, dated August 16, 1892.

Application filed December 4, 1891. Serial No. 414,032. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. TYLER, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, 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 certain new and useful improvements in water-wheels designed to be used with what are known in the art to which my invention relates as "low heads" or "low-water heads," by which are meant that the distance between the mean or the lowest water-line of the water-head and the mean or lowest water-line of the tail-water is comparatively small, the general range of such distance being from six feet to ten feet—that is to say, the distance from the average water-line of the head to the average water-line of the tail will vary from six feet to ten feet, more or less.

It is the object of my invention to provide an organization adapted to such low-water heads and wherein the wheel proper occupies a position above the water-head (more or less) under all ordinary circumstances, but wherein such wheel is below the water-head in times of floods.

It is another object of my invention to provide for conducting the water from such low head up to the wheel by utilizing a portion of the water initially to create a partial vacuum within the hood or inclosing structure of the wheel proper, so that the water will rise into it.

It is another object of my invention to prevent the formation of eddies, air or suction holes in the water in cases where the head rises to an altitude more or less above the wheel proper, the rush of the water into the wheel in such instances creating such eddies, &c., to the impairment of the efficiency of the wheel in the absence of my improvement. There are other subordinate objects and features of my invention, which will be hereinafter pointed out in detail, and particularly referred to the claims.

In the accompanying drawings, on which like reference letters and figures indicate corresponding parts, Figure 1 is a vertical transverse sectional view of a water-wheel organized to show one exemplification of my invention, the section being on the line *x x* of Fig. 2; Fig. 1ª, a detail of the gate-operating mechanism. Fig. 3 is an elevation of the driving-pulley, a gate-wheel, and a sectional view of the pulley-pit; and Fig. 2 is a longitudinal section of my improved water-wheel on the line *y y*, Fig. 1, the hood and other parts being also in section to facilitate in illustration.

The letter A designates a penstock constructed of wood, as usual, and connected at one side with the mill-race B and opening in the lower part or bottom into the tail-race C. The water in passing from the mill-race to the tail-race goes through the water-wheel and operates it.

The wheel is mounted in the penstock in the following manner: The bottom of the stock supports a flange D, to which is secured a discharge-flume E, which extends down into the tail-race and up into the penstock. Carried by this flume is a wheel-casing F of cylindrical form. A shaft G passes centrally through this case and is mounted in stuffing-box bearings H, supported by the walls of the penstock. This shaft carries two water-wheels proper, (designated I and J,) the type of which may be varied to suit the exigencies of the occasion, the choice of the builder, or the requirements of the user. In the present illustration the wheel is of the type known on the market as the "Leffel" wheel, (lateral discharge,) having a set of buckets K and a set L. Encircling these wheels are annulii M and disks O, suitably supported, respectively, by the case F and the shaft G. Between these annulii and disks are mounted pivoted gates P, operated through a segment-arm Q, connecting by rods with studs on the gates. The arm Q has a hub R mounted on the sleeve S of the disk O. This sleeve fits upon the shaft G. A rod T, mounted in the stuffing bearing-box U, carried by the penstock, has a hand-wheel V and extends into the arm Q, where it has a pinion W meshing with such arm. This mechanism is in duplicate, the wheel at either end of the case F being so equipped.

The construction here described is a con-

venient form; but the invention is outside of such details.

While two wheels are preferred to one wheel of the same power as the two wheels, still I wish to be understood as stating that by the employment of one wheel rather than two, the other particulars of my invention being retained, it will not thereby be departed from. When two wheels are employed and their gate-operating mechanisms kept separate in the sense of operating the gates of the one wheel without operating those of the other, then either or both wheels may be used at a time. It will also be observed that these wheels are independent, so that one may be used without the other, or both may used at the same time.

At Fig. 2 is shown a hood, shell, or cover 2. This is preferably made of sheet metal, the body part being secured to flanged heads 3 and the whole mounted within the penstock and arranged to envelop or inclose the wheels proper, their case, and the upper portion of the discharge-flume. Viewed in Fig. 1, this hood or casing is seen to extend down somewhat below the lower part of the wheels proper. This hood or casing has two essential functions. One of them comes into operation when the head-water is below the wheels in the sense that it is not high enough to properly or wholly feed the wheels by seeking in the penstock a level to agree with its head. The other comes into operation when the head-water is high enough to feed the wheel without being elevated for that purpose, and the function in such latter case is to prevent the creation of eddies, whirlpools, &c., and air-drafts as it enters the wheel. In practice it is found that with only a small body of water—say a foot, more or less—above the upper surface of the wheels such objectionable eddies are formed and air drawn into the wheels and discharge-flume, resulting in retarding and impairing their operation. This hood or casing, so enveloping the wheels, prevents such thin body of water above them from being drawn into them, and therefore avoids these objections.

Referring again to the first-named function of the hood or casing, I would observe that it forms a chamber into which the water will be carried upon creating therein a vacuum or partial vacuum. The water from the mill-race rises to its level in the hood. A gate 4 is then opened by a rod 5 and hand-wheel 6 and water admitted to the passage 7, leading to the flume E below the wheel. The water discharging in this manner through the flume creates a draft and draws the air from the chamber within the hood through so much of the wheels as may be above the water, if any part of them is above it, and also through an air-pipe 8—wholly through the latter when the water has risen high enough to submerge the wheels. Thus a partial vacuum—the more perfect the better—is created in the hood-chamber, when the water will rise in such chamber and operate the wheels, discharging through the flume. When this action is commenced, then the gate 4 is closed. Thus the water is raised to a height above its level in the mill-race, and it is made possible to provide low heads—heads ranging from six to ten feet—with a powerful and effective water-wheel.

The air-pipe 8 is preferably of the form shown, so that its open end is a few inches below the top of the hood, whereby a space is left, which facilitates the movement of the water, as it forms currents in moving to the wheels, particularly when only one wheel is being operated. The floating valve for the air-pipe is seen at 9, being pivoted at 10 and adapted to raise and close the end of the air-pipe to prevent water from entering it.

A pulley-pit 11, preferably constructed of sheet metal, is provided, and the shaft G has a bearing 12 therein. The vessel constituting the pulley-pit is connected with the end of the penstock by a part 13. The stuffing-box between the pulley-pit and the penstock prevents the water rising in the hood-chamber from escaping into the pit when the water in such chamber is up to or above the shaft. This box also prevents air from entering from the pit into such chamber when the water is below the shaft. The function of the pit is to protect the pulley from water when the tail-water is high enough to interfere with it. Again, the provision of the pulley-pit, which protects the pulley, admits of placing the pulley lower than otherwise would be possible, and so consequently permits of placing the wheel-shaft, with its wheels and also the hood, lower. Thus while the wheels are located above the main or usual water-line of the tail-race still the use of the pulley-pit makes it possible to lower them, and thus shorten the distance to which the water must be raised by atmospheric pressure and induced to rise in the hood-chamber by the vacuum or partial vacuum created therein. Links or rods 14 assist in sustaining the hood. The sleeve S has a flange 15, and between it and a disk 16 are blocks 17, preferably of wood. The set-screws 18, carried by the flange 15, and the disk 16, act to adjust these blocks up to the shaft as they wear. The general frame of the wheel proper, consisting, essentially, of the annulus M and disk or plate O, to which latter a sleeve S is rigidly keyed, being a rigid structure, as is common, thereby supports the sleeve S, the flange 15, and the disk 16. Thus a support by the blocks and the sleeve S is constituted for the shaft. It will be understood that this construction is merely a usual one in water-wheels of the Leffel kind and that it is in duplicate in this case, each wheel proper having it. It is no part, however, of my invention.

I have illustrated by dotted lines several altitudes to which the water-head and the tail-water may rise or drop. Should the water-head be as high as shown at the line 18, then

the hood will perform the function of preventing eddies, whirlpools, and air-drafts, whereby the air is drawn into the wheels and discharge-flume. Should the head assume the altitude shown in the line at 19, then the other function comes into play and the vacuum or partial vacuum is formed within the hood for the purpose described. Should the tail-water assume the altitude of line 21 or any altitude above the bottom of the pulley-pit by which the power is transmitted, then the pit-box 11 protects the pulley.

I wish to be understood as not limiting myself to the special arrangements or construction illustrated and described. It is obvious, too, that should the circumstances surrounding the location at which any specimen of this invention may be put in use result in the head-water never rising high enough to dispense with the use of the vacuum feature described herein, then my invention is nevertheless present, notwithstanding that one function of the hood is not called into operation. The converse of this is also true, notwithstanding that it is a special object of this invention to place the wheels higher than the head-water in whole or in part.

Besides letting the water pass through the gate 4 to exhaust the hood-chamber, I have found that such chamber may be exhausted without opening the gate in case the head-water should rise high enough to enter the wheels proper—say in the portion of them below the shaft. To illustrate, suppose the head-water should rise to line 21, (marked "mean head.") Then the vacuum or, strictly speaking, the partial vacuum may be formed by opening the gates and allowing the water to enter the wheels and pass down the discharge-flume E, the air being drawn down through the upper portion of the wheels. As the water rises in the hood-chamber as the air is exhausted it will finally reach the top of the wheels and cause the remaining air to be exhausted and to pass out of the air-pipe 8 until, indeed, the float closes this pipe.

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

1. In a water-wheel, the combination, with a wheel proper and its adjuncts and a discharge flume or passage, of an inclosing flume or structure within which such wheel is located and a valvular device mounted on the top of said hood to admit water into such flume or discharge-passage initially and shut off said water therefrom after the preliminary operation of the wheel, whereby the air is drawn from the chamber within such hood or inclosing structure and the water is raised about and above the wheel and above the head.

2. In a water-wheel, the combination, with a wheel proper and its adjuncts and a discharge flume or passage having an opening in the discharge-flume below the wheel to admit water into the flume or passage, of an air-discharge pipe or passage leading from the upper part of the chamber within such hood or structure into such flume or discharge-passage, for the purpose set forth.

3. In a water-wheel, the combination, with a hood, of a discharge-flume, an air-discharge pipe bent reversely in a hook shape and connecting the upper part of the hood and the flume, and a float adjacent to said pipe adapted to close the same automatically, as and for the purpose described.

4. In a water-wheel, the combination, with a wheel proper and its adjuncts and a discharge flume or passage, of a hood or inclosing structure within which such wheel is located and an air pipe or passage leading from the chamber formed within such hood or structure to the flume or discharge-passage, whereby the air in such chamber may be exhausted as the water passes down said flume or discharge-passage and whereby vacuum-space is formed to permit the water to rise in such hood or structure.

5. In a water-wheel, the combination, with a wheel-case and wheel proper at either end thereof, independent gate-operating devices for each wheel proper, and a discharge-flume connected to such case, of a hood or inclosing structure within which the case and wheels proper are located and a controlled water-opening leading to such flume below the wheels, whereby water may discharge through it and produce vacuum conditions in the chamber within such hood or structure to effect the elevation of the water therein to an altitude above the head.

6. In a water-wheel, the combination, with a case, a wheel proper at each end thereof, independent gate-operating mechanism for such wheels, and a discharge-flume connected to such case, of a controlled opening in the flume for the purpose described and a hood or inclosing structure within which the case and wheels are located, and an air-discharge pipe or passage leading from the chamber within the hood or structure to the flume, for the purpose described.

7. In a water-wheel, the combination, with a case, two wheels proper, and a discharge flume or passage, of a hood or inclosing structure within which such case and wheels proper are located and a controlled water-opening in the flume or passage, for the purpose described.

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

WILLIAM W. TYLER.

Witnesses:
OLIVER H. MILLER,
WARREN M. MCNAIR.