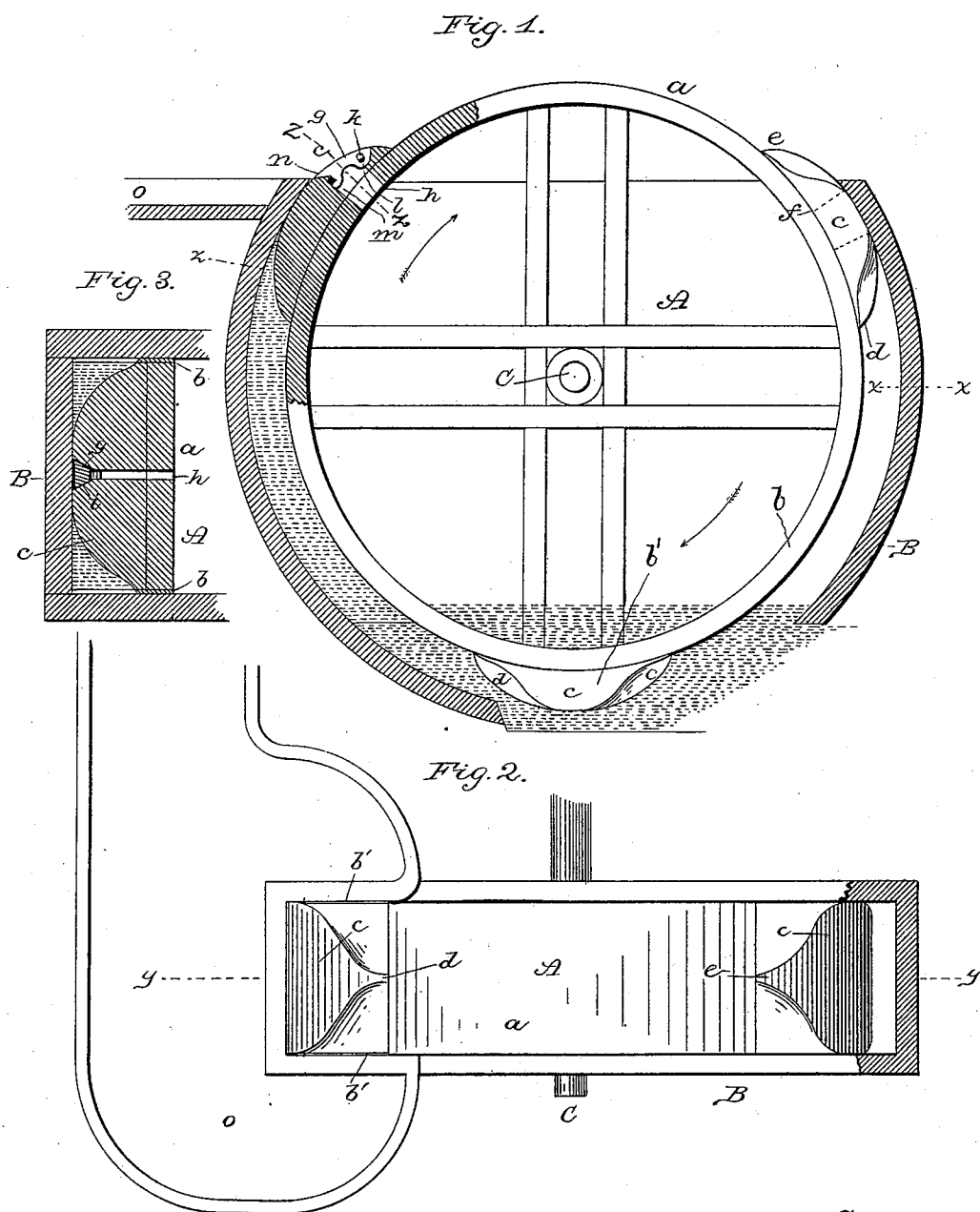


(No Model.)

R. F. GRAY.  
NORIA.

No. 601,957.

Patented Apr. 5, 1898.



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# UNITED STATES PATENT OFFICE.

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## NORIA.

SPECIFICATION forming part of Letters Patent No. 601,957, dated April 5, 1898.

Application filed October 8, 1897. Serial No. 654,567. (No model.)

*To all whom it may concern:*

Be it known that I, REUBEN F. GRAY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented a new and useful Noria of the class particularly designed for use in raising water for irrigating purposes, of which the following is a specification.

My invention relates to an improvement in norias designed especially for raising water for irrigating and kindred purposes; and it consists in the peculiar shape of the buckets, whereby the resistance offered to their passage through the water at the lower side of the wheel is lessened to the consequent gain in the capacity of the noria; and it further consists in the valves arranged in the buckets in such manner as to prevent a vacuum from being formed in the column of water on the operating side of the wheel, as will be more fully set forth hereinafter and particularly pointed out in the claims.

The object of my invention is to provide an apparatus for raising water for irrigating and kindred purposes which shall be of increased capacity with a given horse-power, which shall be of such simple construction that it may be readily made and arranged for operation by the ordinary millwrights and artisans to be found in country places, which shall be very strong and durable, and which shall raise the water by suction into the confined space formed by the casing on the working side of the wheel.

In the accompanying drawings, Figure 1 is partly an elevation and partly a sectional view on the line *y y* of Fig. 2 of a wheel and its inclosing case embodying my improvements. Fig. 2 is partly a top plan view and partly a longitudinal section of the same on the line *x x* of Fig. 1. Fig. 3 is a detail section taken on the line *z z* of Fig. 1.

The wheel *A* is mounted concentrically in the case *B*, which is of circular form, with its upper portion cut away at a suitable height or level and its lower portion on one side also cut away to allow free ingress of water to the wheel. In practice the lower portion of the casing and of the wheel will be submerged in a ditch or stream and the shaft *C*, on which the wheel is mounted and which rotates in the sides of the case, will be geared or other-

wise connected to a horse-power mill or steam-engine or other suitable motor, so that the wheel will be revolved in the casing, the latter of course remaining at all times stationary.

The rim *a* of the wheel is closed and entire, but the framework or spokes thereof are open and of such construction as may be preferred, either of wood or iron rods, as may be found to be most suitable or economical. The rim of the wheel fits snugly between the sides of the casing and is adapted to revolve between them and is packed with leather or other suitable material, as at *b*, to effect a practically water-tight joint.

Arranged on the rim of the wheel are a series of suction-buckets *c*, preferably three in number; but this number may be increased at will, which suction-buckets are spaced at regular intervals apart. The cross-sections of the buckets correspond with the cross-section of the space between the casing and the rim of the wheel, and the ends of the suction-buckets which are presented in the direction of the rotation of the wheel (indicated by the arrow in Fig. 1) are reduced to a wedge or prow shape, as at *d*, and thereby adapted to move through the water on the lower side of the wheel with the least possible resistance thereto, thereby very greatly reducing the "dead" resistance and enabling the wheel to be rotated by a force only slightly in excess of that required to lift the column of water on the working side of the wheel between two of the buckets and the wheel-rim and the casing, as will be readily understood. As each of the suction-buckets ascends its tendency is to create a partial vacuum on the working side of the wheel, thereby causing a column of water to ascend behind the said bucket, and the buckets are so spaced that just before the topmost bucket clears the upper portion of the casing the next bucket following enters the confined space between the casing and the rim of the wheel below the column of water which is rising, and as the wheel continues to rotate said lowermost bucket lifts the column of water which was sucked up behind its predecessor, causing the water to be discharged over the sides of the casing onto a suitable trough or conveyer *e*, which conducts the water to the field where it is to be employed.

It will be understood from the foregoing that by causing the buckets to act as suckers and by giving them the wedge or prow shape the dead resistance of the water in which the lower portion of the wheel is submerged is reduced to the minimum, thereby greatly enhancing the efficiency of the device. The rearsides of the suction-buckets may be either lengthened out and given a stern wedge shape, as at *e*, to facilitate the escape of the water from the buckets as they successively rise above the casing, or they may be cut off radially, as at *f*, Fig. 1, the former being preferable when the wheel is to be rotated at a comparatively high rate of speed and the latter being preferable or sufficient when the wheel is to be operated at a low rate of speed. The sides of the buckets are also packed with leather or other suitable material, as at *b'*, to prevent the escape of water between them and the sides of the casing.

When the wheel is in rotation and operation, just before each of the buckets in succession rises above the side of the casing and while its tendency to create a vacuum below it is at its maximum its successor is entering the working water space or chamber formed between the casing and the working side of the wheel and hence cutting off the supply of water thereto. As the orifice diminishes, the speed of the column of water entering the said space or chamber is reduced by operation of the *vena contracta*, thus causing an additional load to be at this instant imposed upon the working side of the wheel, which manifests itself in a sudden shock and tends seriously to damage the wheel and its casing and to retard the speed of the wheel. In order to prevent this injurious stress, I provide each of the suction-buckets with a valve *g*, which fits in a longitudinal opening *h*, made in the keel of the bucket and extending through the rim of the wheel, the outer portion of said opening at its sides and ends being flared outwardly, as at *i*, to form a seat in which the valve normally rests with its outer side flush with the face of the bucket. The rear end of each of the valves is pivoted on a pin *k*, the hole in which the pivot is being enlarged radially with reference to the center of the wheel, as at *l*, to admit of the radial movement of the valve on its pivot-pin, and the front end of each valve has an arm *m*, adapted to engage a shoulder *n*, formed under the valve-seat in the recess or opening *h*,

thus adapting the valve to move radially also at this end, and hence rendering the valve capable of radial motion with reference to the center of the wheel in its seat, and as the sides of the latter flare outwardly it will be understood that when the valve moves outwardly it opens the opening *h* and permits the free passage of air therethrough from the interior of the wheel into the column of water on the working side thereof, and when the valve is seated it closes said opening and prevents the escape of air through the rim of the wheel into the column of water. The pressure of the column of water will suffice to normally keep the valve seated; but when the inflowing stream of water produces a *vena contracta* and thus tends to create a vacuum the valve will move outwardly in its seat and admit air to the water-space in sufficient quantity to prevent the stress which would otherwise be caused by the vacuum, as will be readily understood.

The form of valve herein shown and described is merely a preferred form and may be departed from and varied without departing from the spirit of my invention, which contemplates, broadly, any preferred means for admitting air to the water-space and preventing the injurious rack and stress caused by the formation of the vacuum.

Having thus described my invention, I claim—

1. In a noria, in combination with the wheel A, and the casing, the buckets *c* on the periphery of said wheel, said buckets being prow-shaped, as at *d*, for the purpose set forth, substantially as described.

2. In a noria, the combination of the wheel having the buckets, the casing forming a water space or chamber on one side of the wheel, and the valves, to prevent the formation of a vacuum in the said water space or chamber, substantially as and for the purpose described.

3. In a noria, the combination with the casing, forming the water space or chamber, of the wheel A having the peripheral buckets, the said buckets having their front and rear ends respectively prow-shaped, as at *d*, and stern-shaped as at *e*, for the purposes set forth, substantially as described.

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