

(No Model.)

2 Sheets—Sheet 1.

H. C. STILWELL.
FLUID MOTOR.

No. 479,855.

Patented Aug. 2, 1892.

Fig. 2.

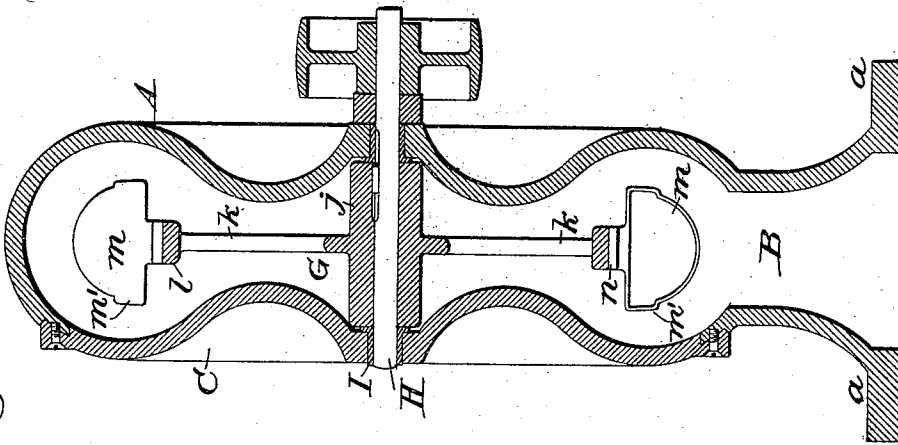
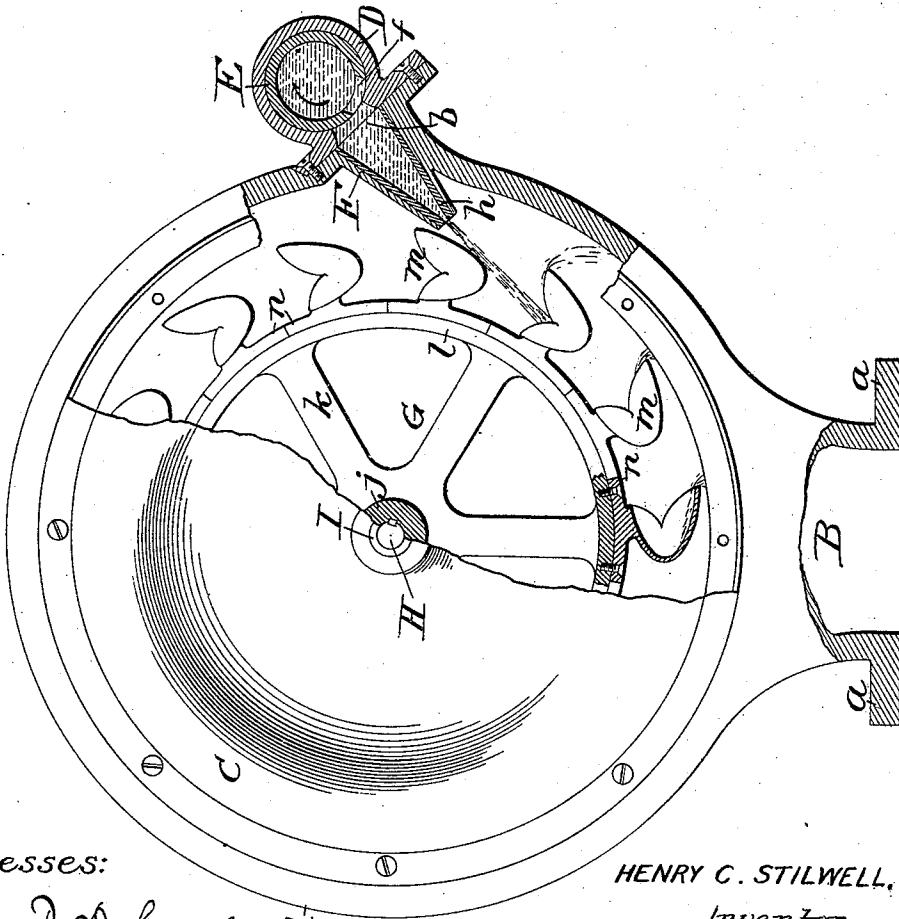


Fig. 1.



Witnesses:

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Horace A. Dodge.

HENRY C. STILWELL,

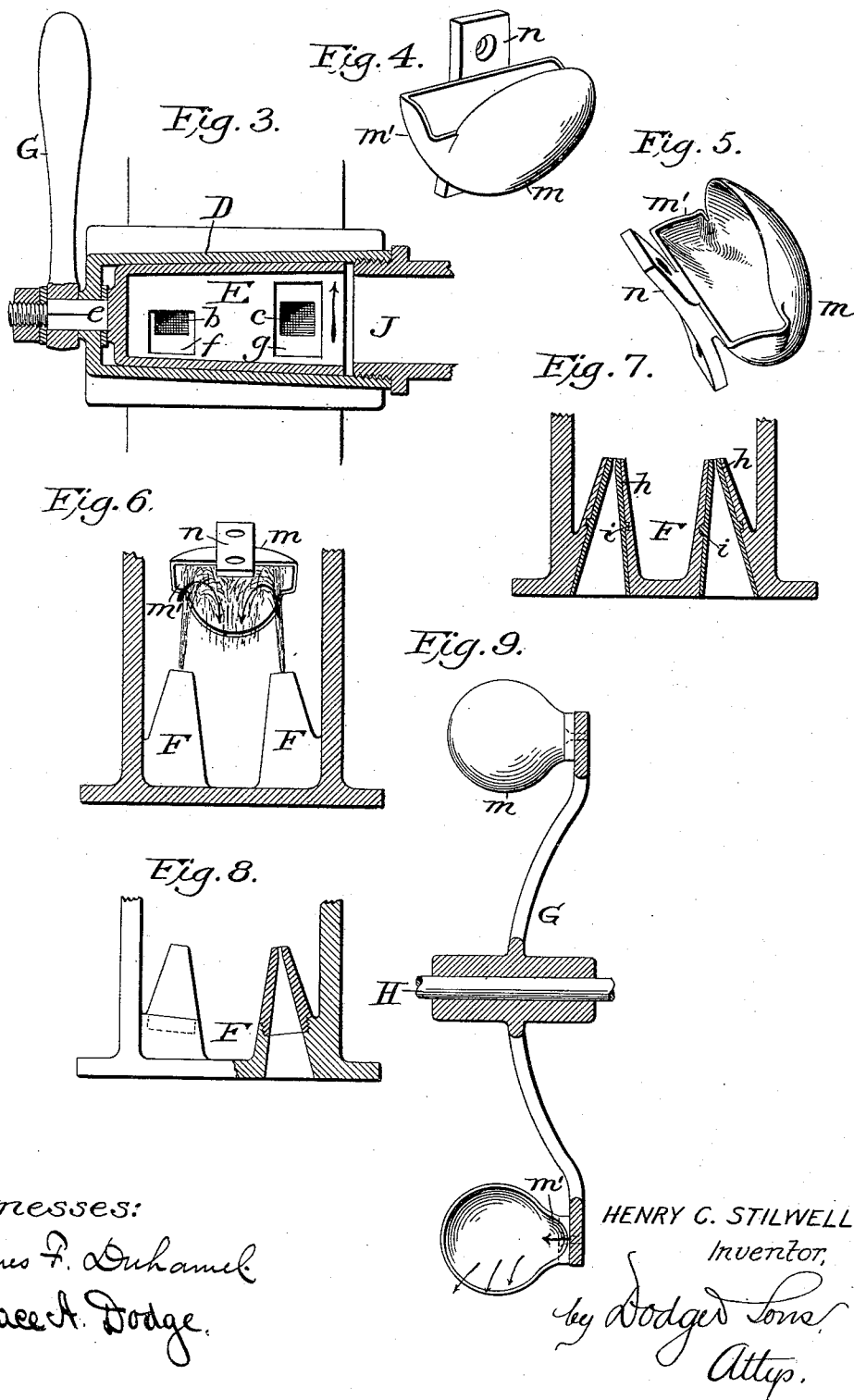
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UNITED STATES PATENT OFFICE.

HENRY C. STILWELL, OF DAYTON, OHIO.

FLUID-MOTOR.

SPECIFICATION forming part of Letters Patent No. 479,855, dated August 2, 1892.

Application filed July 28, 1891. Serial No. 400,941. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. STILWELL, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Fluid-Motors, of which the following is a specification.

My invention relates to motors, and is designed more particularly for those actuated by jets or streams of water under considerable head or pressure, though it may be driven by steam or other fluids.

The invention consists in a number of novel features, combinations, and details, which will be hereinafter pointed out in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of my motor with the side of the casing removed and portions shown in section; Fig. 2, a transverse vertical section through the same; Fig. 3, a sectional view of the valve by which the jets are regulated and controlled; Figs. 4 and 5, perspective views of one of the buckets of the wheel; Fig. 6, a view illustrating the action of the jets upon the buckets; Fig. 7, a sectional view of the nozzles, showing the manner of forming or producing them. Fig. 8 represents a modified arrangement of the nozzles, and Fig. 9 a modified form of bucket designed for very small sizes of motors.

In constructing my motor I provide a shell or casing of the form illustrated in Figs. 1 and 2—that is to say, of circular form—the central axis occupying a horizontal position. In transverse section the case or shell is advantageously, though not necessarily, of circular form in its outer portion, being contracted or drawn in between said circular outer portion and the central part, which latter is widened to receive the hub of the wheel. At its lower side the shell A is formed with a tubular neck B, through which the waste or spent water or fluid is discharged, and which is flanged or spread out to form a base or footing upon which the motor is supported. This flange *a* may be provided with holes to receive bolts or screws by which to secure it firmly in position.

To permit insertion and removal of the wheel into and from the shell or casing A, I construct the latter with a large opening in one side, which is preferably made circular,

for the reason that its face or walls and the face and edges of the covering-plate C, by which said opening is closed, may be readily and accurately dressed in a lathe when made in such form, and thus a nice fit can be secured at small cost. For the larger sizes of motors the shell or casing may be divided in the horizontal plane of the axis of the wheel, the two parts of the shell in such case being flanged and bolted together in a manner common and well known in this class of machines.

At one side of the casing and a little above the horizontal plane of its center, advisably, but at a different point, if desired, there is a hollow barrel D of cylindrical form, to receive a tubular valve plug or gate E, by which the admission of water or fluid is regulated, controlled, or prevented, as required. The inner side of the barrel D—that is to say, the side next the interior of the shell or casing A—is provided with two openings *b c*, each communicating with the interior of a separate nozzle F, which nozzles project into the shell or casing, as seen in Fig. 1. In practice it is found advantageous to direct the nozzles downward at an angle of forty-five degrees, more or less, as under this arrangement the weight, as well as the impact of the water, is fully utilized. The most important advantage of this arrangement is, however, the fact that the water is thereby directed to the outlet and is prevented from being thrown off into the body of the shell or casing, whether the speed be high or low.

The construction of the valve or gate E is illustrated in Fig. 3, by reference to which it will be seen that the bore of the barrel D is made tapering, and that the plug E is of like form, so that a close fit may be made and maintained, the plug being drawn longitudinally inward to compensate for wear, as is common in cocks and faucets. Projecting axially from the smaller end of the plug or gate E is a stem *e*, the outer end of which is preferably squared to receive an actuating-handle G, a hand-wheel, or other device for turning it.

As shown in Fig. 3, the two openings *b* and *c* of the barrel D are of the same size and are similarly located with reference to the nozzles F; but the openings *f* and *g*, through

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which the fluid passes from the interior of the plug or gate E to the openings *b* and *c*, differ in that the opening *g* has a measurement in the direction of the circumference of the plug equal to twice that of the opening *f*. The two openings *f* and *g* have either their upper or their lower edges in the same plane horizontally, or practically so, the lower edges being thus represented in the drawings. From this construction it follows that when the plug or gate is so set as to carry the openings *b* and *c* wholly out of register with the openings *f* and *g* no water can pass to either of the nozzles F, and by turning the plug in the direction indicated by arrow in Figs. 1 and 3 the upper half of opening *g* will first come into register with opening *c* and will fully open the passage to its nozzle before beginning to open communication through openings *b* and *f*. If, however, the movement be continued, the opening *f* will be caused to register with opening *b*, while the lower half of opening *g* will move upward and take the place of its upper half, thus leaving the opening *c* fully uncovered. This construction and arrangement is to enable the attendant to turn or cut off the supply of water or fluid to one nozzle without affecting that of the other, and thereby to permit the motor to run with half or with full supply of water, but with full supply in the nozzle or nozzles used. This feature is one of considerable importance, for the reason that the proportions of the nozzles are such that the full efficiency of their jets can be secured only when the full quantity of water or fluid is delivered to the nozzles and the loss in efficiency decreases in a more rapid ratio than the decrease in supply of water or fluid. By my plan I maintain the full supply of water or fluid in the nozzle or nozzles used, and consequently get the full benefit of impact, though being able to vary the quantity used at will.

In the drawings I have represented the barrel D as formed in a separate piece or casting from the shell or casing A, and secured thereto by tap bolts or screws, a construction which is not necessarily to be followed, but which is preferred because of the greater ease of casting and of finishing the parts.

As shown in Figs. 1 and 7, the nozzles F or the bodies thereof are cast integral with the main shell or casing A; but to give them a better finish and proportion than can be done in iron casting I cast within the body and about a suitable mold or core a lining *h* of Babbitt metal, pewter, or the like, or I make use of a lining of brass or other alloy or metal. If desired, the nozzles F may have an internal groove *i* and the lining *h* be cast or expanded into the same to prevent displacement; but it is not essential to provide the grooves *i*, as the plate of the barrel or casting D will effectually hold the linings in place when the parts are assembled, and if the

groove be omitted the lining can be readily removed for renewal or replacement by others of different proportions, should this be desired. This capability of ready change of the linings is advantageous in that it enables the constructor or the user to readily adapt the motor for use with different fluids or varying pressures.

For larger sizes of motor where there is sufficient room to make an opening through the side of the casing I prefer to apply the nozzles or tips from within the shell or casing, screwing them into suitable threaded openings, as indicated in Fig. 8. By this arrangement the necessity of disconnecting and recoupling the supply-pipe when a change of nozzles is required is obviated. The water or fluid is delivered by the nozzles F upon or into buckets *m* of a wheel G, which latter is of peculiar construction, and is especially designed to prevent the spent water from being carried beyond the discharge-opening or from interfering with the free rotation of the wheel.

Referring now to Figs. 1, 2, 4, and 5, this construction will be explained. G indicates the wheel as a whole, consisting of a central hub *j*, radial spokes *k*, for which a solid disk may be substituted, if desired, an annular rim or felly *l*, and a series of buckets *m*, which latter are cast separately and riveted or otherwise made fast to the rim or felly *l*. The central hub *j* is made of a length slightly less than the distance from one side wall of shell or casing A to the other, and is centrally bored to receive a shaft H, the ends of which extend through flanged bushings I of bronze, brass, or the like applied to holes or openings made in the side walls of the shell or casing, the flanges of the bushings being placed on the inside of the casing to prevent the bushings being forced out. The flanges of the bushings I are of proper thickness to fill the space left between the ends of the hub *j* and the side walls of the shell or casing, the fit being such as to afford free movement of the wheel without lateral play.

The buckets *m* are of the form illustrated in Figs. 1, 2, 4, and 5, and somewhat resemble the small end of an egg-shell, with lateral wings or enlargements *m'*. The body of each bucket curves outward away from the felly or rim *l*, then makes a short bend, and finally a reverse curve, as shown in the sectioned bucket of Fig. 1. The wings *m'* project laterally, and are designed to receive the water from the nozzles F and to direct the water toward the center, whence it is discharged over the outer curve, as indicated in Figs. 1 and 2.

Owing to the construction stated and to the arrangement of the nozzles to deliver their jets into or upon the wings or lateral extensions *m'*, the jets will have a direct and clear passage to the point of meeting, even though a small quantity of water remain in and be carried around with the buckets, a contingency which is not met with in practice. The

curvature of the buckets, the direction of the water toward the center thereof, and the discharge of water at the middle and extreme outer edge of the buckets all contribute to the prompt discharge of the water from the buckets by the time they begin to ascend, and the curvature or inclination of the outer face of each bucket is such as to throw off and outward any water which may be left in its path by the preceding bucket, while the shape of the bucket as a whole is such as to permit it to force its way readily through any accumulation of water within the shell or casing. This latter capability is enhanced by raising the body of the bucket slightly from the lug or plate *n*, by which it is carried or made fast to the felly or rim *l*.

The wheel *G* will be secured upon the shaft or spindle *H* by means of a key, a set-screw, or in any other well-known way. It is advisable to allow considerable space between the wheel *G* and the shell or casing and to provide an ample outlet for the spent water, as the danger of water accumulating therein is thereby lessened or removed. The water or other fluid is brought into the barrel *D* and to the interior of the tubular valve plug or gate through a suitable coupling *J*, screwed into or otherwise connected with the end of the barrel. One end of the shaft or spindle *H*, or both ends, if preferred, will be suitably extended beyond the shell or casing and furnished with a band-pulley or gear-wheel (one or more) or with other common means for transmitting motion to other machinery.

Inasmuch as the shell or casing *A* performs no function other than to support the wheel, the nozzles, and the valve and to confine the spent water within a limited space, it will be obvious that where the scattering of the water is a matter of no consequence, a simple open frame or skeleton may be used instead of a continuous close case. I therefore wish it understood that the term "shell" or "casing" as used in the description and in the claims comprehends not only the close case represented, but also an open or skeleton frame adapted to support said parts. It also applies to another style of close shell or casing.

For very small motors it is impracticable or unadvisable to divide the stream into separate jets, and in such case I provide the bucket with a single wing or enlargement *m'*, making the same in the form represented in Fig. 9. In this, as in the other forms, the water is received in or upon the wing and passes to the curved discharge-lip, which is out of line with the receiving-wing and discharges the water at a point farther from the axis of the wheel than the receiving-wing, so that the water is discharged at a point out-

side of or beyond the line of travel of the receiving-wing and, in fact, outside of and beyond the bucket. Hence it is not liable to interfere with the free movement of the wheel. This feature of directing the spent water away from the bucket and particularly away from the portions of the buckets upon which the water is first delivered is one of great importance, and practical use has demonstrated that there is a material advantage in causing the two streams to meet, as in the double-wing bucket.

Having thus described my invention, what I claim is—

1. In combination with a suitable casing and with a bucket-wheel mounted and arranged to rotate therein, nozzles arranged to deliver water or fluid to the buckets of the wheel, and a controlling valve or gate for said nozzles, consisting of barrel *D*, having openings *b* and *c*, communicating with the respective nozzles, and tubular plug *E*, provided with openings *f* and *g*, adapted to be brought into and out of register with the openings *b c*, the opening *g* being longer in the direction of movement of the plug than the opening *f*, substantially as and for the purpose set forth.

2. In combination with shell or casing *A*, provided with nozzles *F*, detachable barrel *D*, applied to the exterior of the shell or casing, and tubular valve plug or gate *E*, arranged within said barrel, all substantially as described and shown.

3. A motor-wheel provided with buckets comprising lateral receiving-wings and a central discharge-lip.

4. In a motor, a wheel provided with buckets, each comprising two lateral wings or impact surfaces, and a central discharge-lip, said discharge-lip being farther removed from the center of the wheel than the wings or impact surfaces.

5. In combination with shell or casing *A*, provided with nozzle *F*, a removable lining applied to said nozzle, and a valve-barrel *D*, applied to the shell or casing and serving both to contain a regulating-valve and to retain the nozzle-lining in place.

6. In combination with a water-wheel having buckets provided with lateral receiving-wings and an intermediate discharge-lip, two nozzles arranged to deliver the water simultaneously upon said wings, whence it is directed toward and discharged over the intermediate discharge-lip.

In witness whereof I hereunto set my hand in the presence of two witnesses.

HENRY C. STILWELL.

Witnesses:

FRANK S. BREENE,
BENJAMIN F. MCCANN.