No. 714,627. Patented Nov. 25, 1902.

R. WILSON.

STEAM TURBINE.

(Application filed May 2, 1902.)

(No Model.)

Fig. 1.

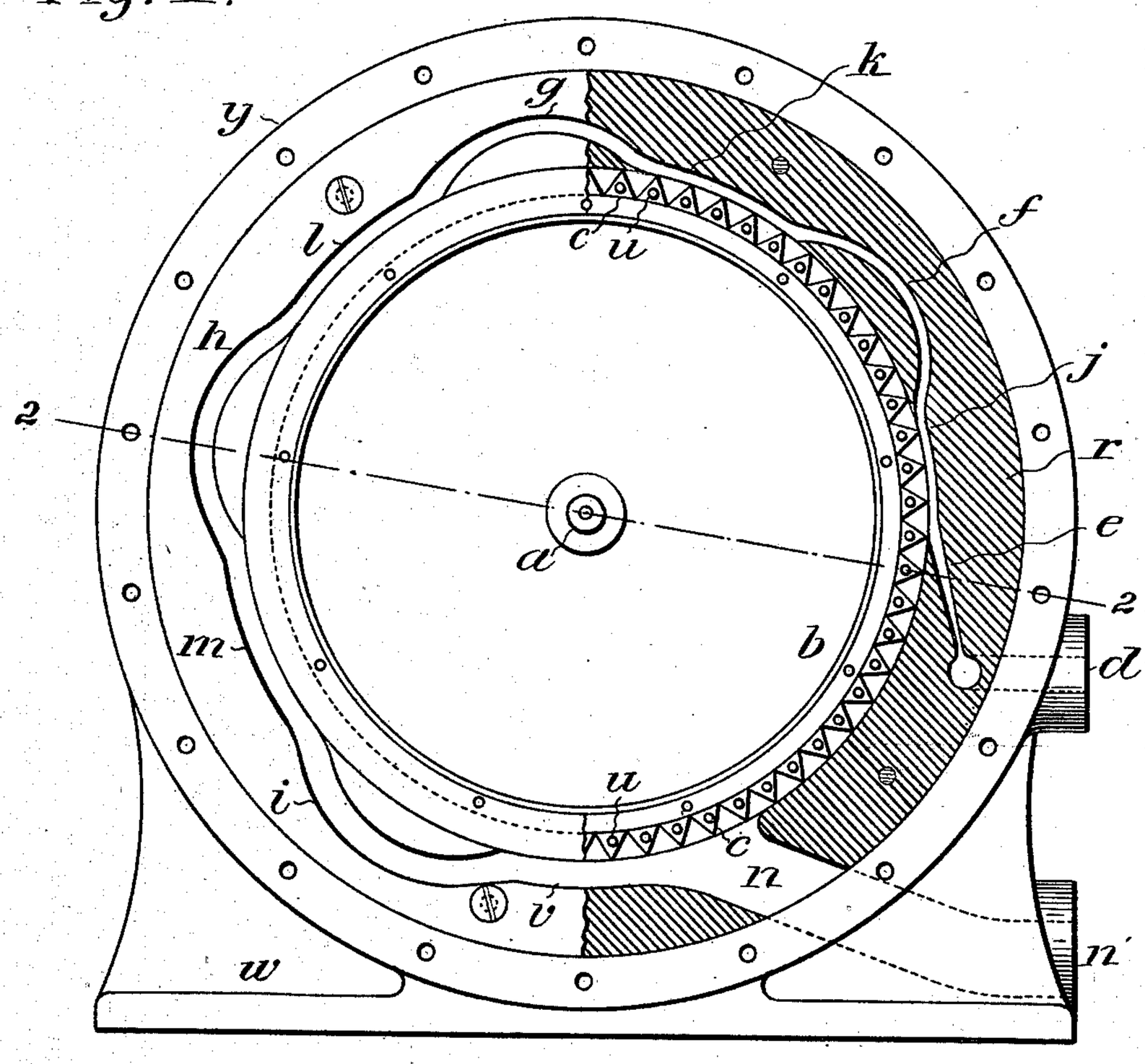
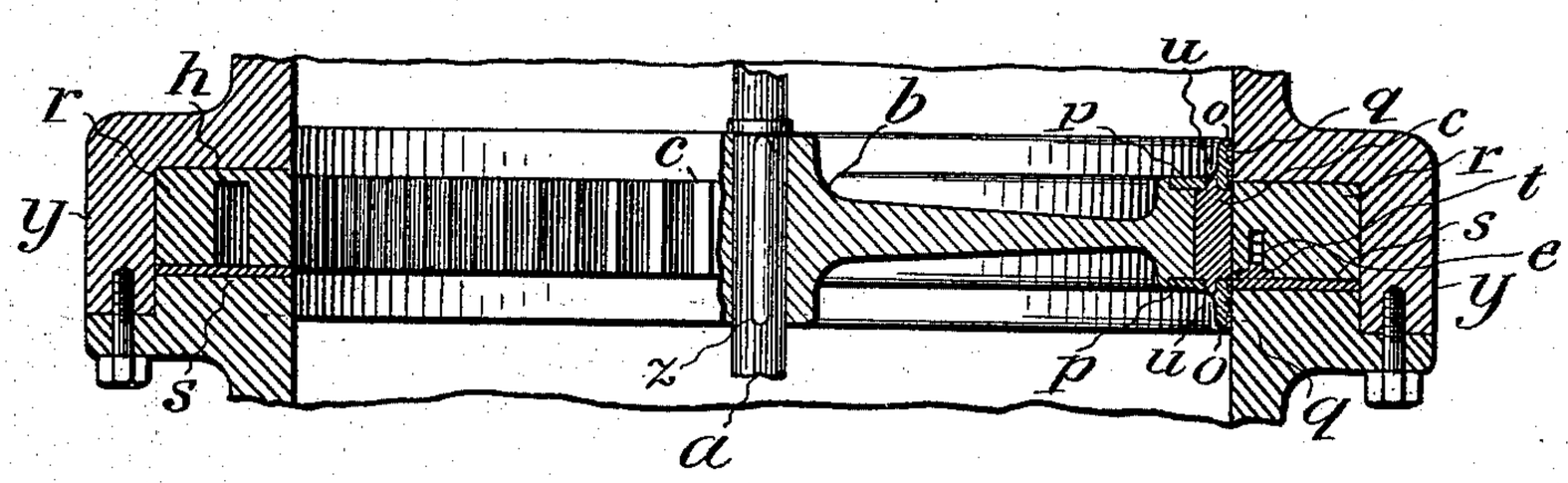


Fig. 2.



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UNITED STATES PATENT OFFICE.

ROBERT WILSON, OF SCHENECTADY, NEW YORK.

STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 714,627, dated November 25, 1902.

Application filed May 2, 1902. Serial No. 105,655. (No model.)

To all whom it may concern:

Be it known that I, ROBERT WILSON, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Steam-Turbines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to steam-turbines or impact-motors driven by the energy of jets of steam acting on the periphery of a driven wheel, the object of the invention being to obtain efficiency at a much lower peripheral speed than has hitherto been attainable in this class of motors. In the original motors of this class, following the water-impelled impact-wheels, the steam after suitable expansion was directed against a series of receding vanes or buckets of such form as to theoretically reverse the direction of motion of the impelling-jet as nearly as possible, and thus absorb the whole energy of motion of the jet by transformation into motion in the motor, which latter to have the highest efficiency should have a peripheral velocity one-half that of the impelling-jet. This excessively-high speed not only reached the limit of the mechanical possibilities of the materials employed, but to be available necessitated gearing down to ordinary speeds, even though such gearing was highly absorptive of power and otherwise objectionable.

My improvement aims to dispense with the complication of unnecessary gearing and to secure directly a moderate and workable velocity in the motor by simple means yielding a high efficiency, avoiding sudden reversals of motion or extreme changes of direction in the impelling-jet, the latter giving out its energy of motion to the motor-wheel by stages as fast as the latter is able to transform it, conserving the remainder after each stage to be utilized in a subsequent stage without loss, the steam-current traveling constantly forward, and all stages coöperating to the attainment of the final and normal velocity of the mechanism until the available energy has all been imparted to the motor-wheel and the completely-deënergized steam passes to exhaust or to condenser.

In the drawings forming a part of this specification, Figure 1 is a vertical elevation of the motor, partly in section. Fig. 2 is a transverse section, partially in plan, of the said motor, taken on line 2 2 of Fig. 1.

w is the main base.

y is the casing.

a is the central shaft. *b* is the motor-wheel mounted on said shaft. *c c* are vanes on the periphery of said wheel.

d is the steam-inlet, *e* the expansion steam passage or nozzle leading to the vanes of the motor-wheel.

f g h i are by-passes or intermediates for the passage of the steam in its progress through the several stages of action in the motor.

j k l m v are the several stages in the path of the steam where action successively takes place upon the motor-wheel.

n is the passage leading the exhaust-steam to the atmosphere, to a condenser, or to other stages of a multiple wheel where compounding shall appear desirable.

p represents the side plates of the periphery of the motor-wheel, flanged at *o* and provided with water-grooves *q q* to prevent the lateral escape of steam at the rotating juncture.

r is the annular member of the motor-case in which the intermediate passages *f g h i* are incised or contained. *s* is the annular plate closing said intermediates.

t is the stop-piece closing the steam-passage *e*.

u u are the pivots of the removable vanes *c c*.

z is a key for shaft *a*.

The steam passage or nozzle *e* is made expansive in the usual form to provide for the requisite expansion of the steam from the high temperature, pressure, and compressed volume at which it is admitted to the nozzle to a suitable volume, temperature, direction, and kinetic energy for acting by impact on the vanes *c c* of the motor-wheel against which the jet impinges. The whole desired expansion may take place in this initial passage or it may be distributed through the several intermediates by an additional expansion at the end of each, which are slightly widened for the purpose, as shown. The widening of passage *e* and the other passages may be transverse or lateral, or both. The intermediate passages are made of successively-increased

capacity or area to provide for carrying the same current of steam at reduced velocity, since the steam is nowhere absorbed and there is very little leakage or condensation. The stages *j k l m* are also preferably successively increased in length at each stage to provide for equable action upon the vanes at the constantly-reduced velocity of the current, which at each stage approximates more nearly to the normal velocity of the wheel and at the last stage should be measurably equal to that velocity, provided the energy of the steam-current has all been availed of by transference and compounding is not resorted to. In the latter case the several stages are simply distributed proportionally throughout the series of compounded motor-wheels, which are arranged side by side on the same shaft in the usual manner. I have in the present illustration shown four stages on the motor-wheel *b;* but any number desired may be employed. If it is desirable and practicable to use a motor-wheel of large diameter, a large number of stages may be arranged for action upon one wheel; but if owing to lack of diametral space or other considerations a large diameter of wheel is not available a number of motor-wheels may be mounted upon the same shaft and the requisite number of stages for exhausting the energy of the steam distributed among them proportionally, as above stated, with the same effect. For reversing also a similar wheel or wheels is mounted upon the same shaft, operated upon by a nozzle in the reverse direction.

The vanes *c* are preferably made removable and replaceable, as the principal wear in the machine is upon the vanes. For this purpose they are provided with the pivots or projections *u*, fitting into corresponding apertures in plates *p;* but this detachability may be provided for in any suitable and workmanlike manner. The vanes also may be of any shape most suitable for the function of taking up the proper share of the motive energy of the impinging jet and at the same time permitting the current to pass on with its remaining store of energy unimpaired for other stages without throttling or eddying, as it is not designed in this turbine that each bucket shall theoretically transform the whole store of energy of a section of the jet included between two buckets, and thereby convert the kinetic energy of the section into motion in the wheel at a single impulse, an object which cannot practically be accomplished.

Operation: Steam at high temperature and pressure is admitted through inlet *d* into expanding-nozzle *e*, wherein it undergoes increase of volume with proportional diminution of temperature and acquires projectile velocity and kinetic energy with which it impinges upon the vanes *c* in its path in a direct line approximately tangential to the wheel. To these vanes it gives up a portion of its kinetic energy and sets them in motion, while the steam-current passes on through stage *j*, wherein it still continues to act with its residual energy on the moving vanes over which it is enabled to pass, the stage *j* being of just sufficient capacity to carry the current constantly forward at reduced velocity without substantial check more than that occasioned by the transference of a portion of its kinetic energy to the wheel. It here enters the intermediate passage or by-pass *f* with but slight deflection, whence it emerges to impinge upon the moving vanes in stage *k*. It may take a slight degree of expansion on emergence if not fully expanded to the working limit previously. At this point it again operates upon the vanes of the moving wheel, giving up to them a second portion of kinetic energy, since the vanes at this stage by no means have the velocity of the moving current of steam. After passing through this stage the steam-current passes into intermediate passage *g*, which is of capacity just sufficient to carry the current at its reduced velocity, where it impinges upon the moving vanes in stage *l* and gives up another portion of its kinetic energy, again accelerating the movement of the wheel by the transference of energy. The steam-current thus passes through all the different stages provided for it, alternating with the several intermediate passages until its kinetic energy is finally exhausted, its velocity and that of the wheel-vanes become approximately the same, and it proceeds to exhaust through passage *n*. The final velocity of the wheel will depend on the proportion between the factors which govern its motion—to-wit, the wheel's diameter and capacity, the resistance to be overcome, and the relative volume, temperature, and pressure of the steam-supply, all being regulated by the prospective work for which the engine is designed. These motors from their simplicity, compactness, economy, and availability as to regulable speed are adapted to all the uses for which engines of the ordinary types are now employed and to some uses for which they are to be preferred.

While Fig. 1 is shown as a vertical elevation, it is obvious that this motor can be used with the shaft either horizontal or vertical or in any desired position.

I claim and desire to secure by Letters Patent—

1. In a steam-turbine, a motor-wheel having vanes on a closed periphery, a steam-passage for directing a jet of steam against said vanes, covered areas or stages at intervals around the wheel inclosing said vanes on the outside and forming passages for the steam-current while acting on the vanes, and between said areas, intermediate connecting-passages for the steam-current, outside of and shielded from the vanes, whereby the steam-current is kept in a continuous path around the wheel, while acting at specified intervals on the vanes cumulatively, to impart its energy of motion to the wheel, substantially as specified.

2. In a steam-turbine, a motor-wheel having

vanes on a closed periphery, an expansion steam-passage for expanding and directing a jet of steam against said vanes, a plurality of covered areas or stages at intervals around the wheel inclosing said vanes on the outside and forming passages for the steam-current while acting on the vanes, and between said areas intermediate connecting-passages for the steam-current, each of successively-increased capacity, outside of and shielded from the vanes, whereby the steam-current is kept in a continuous path around the wheel while acting at intervals on the vanes cumulatively, and a free passage therefor is provided at a continuously-diminishing velocity of current, substantially as specified.

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

ROBERT WILSON.

Witnesses:

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WILLIAM EDWARDS.